

Vetch/Lentil Substitution
A Cautionary Tale of Chemical
Ignorance and Bad News
Suppression
By Max Tate



Australian Roulette
Pick the Toxic Pulse

Vetch/Lentil Substitution:

A Cautionary Tale of Chemical Ignorance and Bad News Suppression.

By Max Tate (June 19 2000, Update June 22 2004)

ABSTRACT:

In 1992 my student Dirk Enneking and I exposed in *Nature*, a multimillion dollar substitution operation. In this deceptive export trade, toxic seeds of the common vetch plant (*Vicia sativa* L.) had been dehulled, the exposed orange cotyledons coated with a thin layer of vegetable oil to deepen the colour and then sold as cheap red lentils (*Lens culinaris* Medik) in third world countries. Lentils are a staple diet for millions of vegetarians in the middle East and the Indian subcontinent.

There are several types of known antinutritional factors in common vetch seed. In the Blanche fleur cultivar, they include a neurotoxin (~1.1%) and favism toxins, (~0.5%). In 1939, Shah ascribed severe illness in malnourished humans, to the consumption of *Vicia sativa*. The lethality of vetch to poultry and the growth retardant activity on rats was traced to the cyano-alanine neurotoxins by Ressler in the 1960's. Vetch seed cannot be legally sold for human consumption in Australia. After much controversy, the Grains Council of Australia ultimately declared in 1993 that *Vicia sativa* was not suitable to be exported for human consumption.

From 1996 onwards the substitution problem gradually re-emerged and in 1999 the scale warranted another letter to *Nature*. The situation was now different. In 1992 there was no lentil industry in Australia, but by 1999 a 75000 mt lentil export industry had been developed and was in jeopardy. The Australian Government moved swiftly to prescribe both vetch and lentils. A "prescribed" grain ensures that exports are true to label when they leave Australia. Pulse Australia, has now declared: **"that the Australian Pulse Industry does not condone this practice and is determined to continue using all means at its disposal to prevent it happening."** As will be shown, in a recurrent "supply demand" situation, such hopes are doomed to failure!

This is the story.

In the Beginning.

(N.B. Appendix documentation appear as lettered superscripts)

The vetch saga commenced innocently enough in 1986, when I was asked by a colleague, a simple question: "Max why don't pigs like Narbon beans (*Vicia narbonensis*)?" This was my first exposure to the *Vicia* species. Most *Vicia* species have evolved in Mediterranean environments similar to our own cereal-growing areas. It is not surprising that these useful nitrogen-fixing vetches grow well in the drier areas of southern Australia and form a valuable part of cereal crop rotations. I submitted a grant proposal to the GRDC (Grains Research and Development Council) and the following year, received funding for a PhD student, Dirk Enneking. With the help of the late Richard Davies a S.A. Dept of Agriculture veterinarian, I soon found out that monogastric pigs didn't like the seeds of some other vetches either, even though the parent plant made good nutritious fodder hay and in some instances (*V. sativa*) provided excellent grain feed for ruminants.

The most spectacular feed-intake effect was with *Vicia villosa* (Namoï vetch) seeds in which we found the causal agent was 2.9% of L-Canavanine^{A1}. L-Canavanine is a structural analogue of the naturally occurring amino acid L-arginine. Pigs will starve to death rather than consume a dietary dosage of 43mg of L-Canavanine/kg/day. Later we isolated and identified a much less potent anti-feedant factor in the Narbon bean as γ -L-glutamyl -S-ethenyl-L-cysteine^{A2}.

Dirk's thorough bibliographic search for vetch antinutrient factors extended to both modern and very early literature on the topic. A 1553 account by Dodoens on the human consumption of the Narbon Bean was tracked down in the Rothamsted library in the UK. It says in part: "if the seed is chewed it filleth the mouth with stinking matter." This is quite consistent with lability of the S-ethenyl group, which necessitated the use of a good fume hood during the isolation of γ -L-glutamyl-S-ethenyl-L-cysteine. No problems.

Problems.

At the end of Dec. 1991, I returned from long service leave to find that Dirk had been asked by a South Australian grain exporter if we would look for toxins in a sample of Blanche fleur vetch (*Vicia sativa*) and also give our imprimatur for its sale for human consumption. I was unaware at that time that a flourishing export trade existed in this particular cultivar, which has an attractive orange-coloured cotyledon. When Blanche fleur vetch is split, its dark outer hull removed and the exposed cotyledon lightly coated with vegetable oil, the colour deepens and it looks very similar (Cover illustration) to the red lentil (*Lens culinaris* Medik). It is thus cheaply and easily "value-added" in readiness for the vetch / lentil substitution trade.

Red lentils are part of the staple diet for millions of vegetarians in both the middle East and on the Indian subcontinent. From Dirk's literature review of the *Vicia* species, we were well aware of a carefully documented 1960's series of experiments by Charlotte Ressler^{B1-B7}, which clearly demonstrated the presence of about 1% of a neurotoxin (γ -L-glutamyl- β -cyano-L-alanine) in *Vicia sativa*. On my return to the lab, Dirk informed me that he had found Charlotte Ressler's neurotoxic non-protein amino acid, β -cyano-L-alanine^{B1}, which gives an un-mistakeable greenish blue Ninhydrin reaction, on his qualitative electrophoretograms of Blanche fleur extracts. I repeated and confirmed all of Dirk's observations.

Charlotte Ressler had also unequivocally shown the lethal effects of both the free β -cyano-L-alanine and its γ -L-glutamyl- derivative on week-old chickens as well as growth retardant effects on rats^{B5}. Furthermore she had established the accumulation in their livers and brains of a non-functional tripeptide analogue of glutathione^{B4,B7} in which the central cysteine moiety is replaced by β -cyano-L-alanine. In addition there was selective inhibition of cystathionase leading to the urinary excretion of sulfur as cystathionine^{B6}. This is a serious problem for vegetarians due to the inherent paucity of sulfur amino-acids in most legumes. However, although β -cyano-L-alanine was commercially available in 1992, after the passage of three decades, Charlotte Ressler's original reference sample of the glutamyl dipeptide was no longer available. We set about re-isolating and crystallising it ourselves. The free amino acid in the extracts is actually a minor hydrolytic artefact of the extraction procedure. The bulk of the toxin is present as the γ -L-glutamyl- β -cyano-L-alanine dipeptide, but at that point we had not yet isolated and characterised it.

Shoot the messenger.

In January 1992, a committee from grains industry funding-bodies visited the Waite Institute. Because of the burgeoning export trade, they had asked Dirk to inform them about this wonderful new Blanche fleur grain for human consumption. At this point, I instructed Dirk to speak only about his successful GRDC funded work on the Narbon bean and Namoi vetch. I broke the bad news from the chemical literature concerning the thermostable neurotoxin in the *Vicia sativa* vetch, known as Blanche fleur.

Thereafter followed hectic correspondence and phone calls. From the original S.A. grain exporter, I soon obtained a copy of a fax^{C1} which he had received from the Australian Quarantine Inspection Service (AQIS) dated February 11 1992 entitled: "False Trade Description -- Export of *Vicia sativa* Described as Lentils" in which it was stated: "Many varieties of vetch contain toxic amino acids

such as β -cyano-alanine making them unsuitable for human consumption. The recently released variety of **Blanche fleur is suitable for human consumption** and in its split form has a similar colour and shape and size as lentil. However, consumer acceptance of this vetch as an alternative food source has been slow." Praise be, for the commonsense of consumers.

"Yes Minister," Chemical Nonsense!

When I told Don Marshall, who had asked me to work on vetches, that this was all chemical nonsense, he advised me to ring Canberra. Fortunately our Waite wheat breeder, Tony Rathjen suggested that I obtain everything in writing from now on. Noting the wisdom of this advice, I faxed Simon Crean, the then Minister for Agriculture on February 25 1992 to ask for the evidence that Blanchefleur vetch didn't contain cyano-alanine toxins and again what was the evidence it was suitable for human consumption? Simon Crean promptly hand-balled it to his luckless junior minister Alan Griffiths (of sandwich shop fame), who in the fullness of time (March 25 1992) replied ^{C2} as follows: **"I have also been informed that AQIS, in response to your facsimile, has informed the Grains Council, exporters and AQIS inspection staff that it is not possible to provide affirmation that the cultivar is fit for human consumption."**

Adelaide Whistle Falls on Deaf Ears, But Resonates in London and Hyderabad.

The tens of thousands of hectares sown to Blanche fleur vetch in 1992 in S.A. and Victoria soon convinced me that my attempts to warn farmers in the Adelaide Stock Journal (April 9 1992) ^{D1} had been totally ignored. It was not until we published an article entitled "A Mess of Red Pottage" in *Nature* on October 2 1992 ^{D2,D2R}, that the denouement was complete. With that single *Nature* article the topic received extensive secondary international media exposure, even appearing on the front page of the Melbourne Age. Three days prior to the *Nature* release the ABC received a rather unflattering fax ^{D3} on my activities from the Grains Council of Australia. One of the three signatories to that fax to the ABC later achieved rare fame by being given right of reply in subsequent *Nature* correspondence ^{D4}.

The Grains Council views, expressed in that correspondence were not well received by the international scientific community. A piece of juxtaposed correspondence by E.G.Brown ^{D5} noted that favism toxins in vetch destined for sale as lentils in middle East countries, made the practice doubly unfortunate. This was because, this is precisely where individuals genetically pre-disposed towards this haemolytic disease are concentrated. Victims avoid the usual source: Faba beans (*Vicia faba*), but they could not knowingly avoid it when vetch was "dressed up" as lentils. The perspective from the Indian Council of Medical Research in Hyderabad was spelt out by Bhat and Raghuram, in the Indian journal "Current Science" in June 1993 ^{D6}. All this publicity rapidly led to a ban ^{D7} on the import of Australian red split vetch by India, Egypt and restrictions by Saudi Arabia and the collapse of an industry based upon false premises. As a result, a series of three post-mortem meetings were then set up for me.

Enquiry #1 (December 4 1992)

The first enquiry was at Turretfield SA, where I attempted to explain my stance to an irate group of local farmers, farm advisers, economists and grain exporters. I provided the irrefutable chemical evidence ^{B1-B7} to an audience which hitherto, had probably considered that chemistry was totally irrelevant to their livelihood. One participant was heard to bemoan the fact that if all the containers of unsaleable Blanche fleur vetch in South Australia were put end to end they would stretch for 10km. My warnings ^{D1} in the Adelaide "Stock Journal" had certainly been ignored. In Victoria the situation was worse.

Enquiry #2 (March 30 1993)

Two other "enquiries" were set up at Ceres House in Melbourne by the Grains Research and Development Corporation which had funded Dirk's PhD. The tenor of the meeting was set when I found the meetings were to be chaired by a director of a Victorian vetch exporting company. There was also a government representative from AQIS. Others included interstate vetch exporting

companies and a Victorian analyst for the grain industries, who had independently confirmed the presence of 1.1% of the toxin. I was closely questioned by a Queensland vetch exporter as to what I knew about how vetch was used in India. I replied that if vetch was sold and treated as lentils (without leaching) and eaten, it was certain that the consumer would receive at least 0.5g of neurotoxin per 100g dry weight consumed. For information on Indian culinary practices, I relied on an Indian Post doctoral fellow (Dr. C.M. Franco). Other participants included an Adelaide human nutritionist and Alan Seawright a University of Queensland toxicologist. Alan Seawright later became a valued colleague and co-author. However, for the most part it seemed to me, that the friends of Max Tate were conspicuous by their absence. I again outlined my case against Blanche fleur for human consumption. Coincidentally (?), "The Weekly Times" (March 31 1993, p10)^{E1} reported: "Grain growers have moved to muffle the freedom of scientists funded by the grains industry, after the destruction of a fledgling \$18 million legume industry." On April 29 1993 the Adelaide "Stock Journal"^{D7} reported: "The Grains Council of Australia has finally come to terms with the Blanche fleur vetch controversy and admitted the issue of toxicity remains unresolved and that the vetch is unfit for human consumption." End of story? Not quite.

Enquiry # 3 (July 28 1993)

Not satisfied with my previous explanations, as to why I had irreparably damaged what had earlier looked like an \$18 million pa industry, a second Melbourne enquiry was convened. Meanwhile Dr. Peter Obendorf from RMIT had drawn my attention to an important 1939 paper by Shah^{E2} describing serious symptoms in malnourished individuals and the recovery which occurred when the vetch was removed from the diet. It is important because of the care taken with the botanical identification of the probable causal agent. The chairman who convened enquiry #2 also chaired enquiry #3. This time he gathered a new group of expert scientific witnesses. Amongst them was a US toxicologist (Dr. Peter Spencer) flown in at considerable expense. He had one of the largest cv's I have ever encountered. Alas, he apparently accepted my concerns and subsequently published an article in 1996 entitled " β -Cyano-alanine Toxicity: Evidence for the Involvement of an Excitotoxic Mechanism"^{E3}. The Adelaide based human nutrition expert, attended both Melbourne meetings. At one of those meetings, he suggested that I had just been lucky to publish in *Nature*. I replied that if that was the case, then in my career I had been lucky on five occasions^{D2,E4-E7} and unlucky on two. At Adelaide airport after the final meeting he made the following memorable statement: "Max you won't do that again, will you?". Little did he know!

Truth and Consequences.

One traditional way that a scientist can be punished for publishing unpopular truths is to block any further funding^{E1}. In such situations, it is well for punishment proponents and recipients to remember that many industry funds are supported by proportional grants from the Australian Government, so there is always this tricky problem of the potential mis-use of public funds, if "business decisions" just happen to take precedence over scientific peer review. Freedom of Information Legislation (F.O.I) may sometimes provide a useful resource. Nevertheless much time can be wasted on such diversionary activities.

How Can You Work Without Any Funds? Answer: With Enthusiastic Students!

I have consistently had every **direct** preliminary GRDC grant proposal rejected since the troublesome 1992 *Nature* article^{D2} was published. Nevertheless, I have been fortunate to receive two PhD students funded **indirectly** by GRDC to work upon the biological chemistry of *Vicia sativa*. The first, Ian Delaere^{F1} was funded in the University of Adelaide via the University of Western Australia. The second student, Jane Rathjen^{F2} was awarded a personal scholarship which enabled her to work with her own choice of supervisor. In addition the French CNRS have forwarded a series of volunteer "Internes"^{F3} to work in my laboratory for six weeks each year. There have also been volunteer mature-age graduates^{F4} who have contributed to our efforts. Without their help the ongoing search for a low toxin vetch would have been an impossible task. The constant and continuing weekly email discussions between my first student on this topic (Dr.

ABC Health Report To The Rescue and Max "Does It Again"!

Upon my return from Spain, I discussed this strange lack of Australian print publicity with my plant pathologist friend and colleague Allen Kerr. He suggested over lunch that I contact Norman Swan of the ABC health report. Norman Swan was away at the time, but when he returned he did an excellent bit of investigative reporting and contacted the Adelaide firm responsible for the 1998 Sri Lankan episode. From the subsequent ABC transcript (19/04/99)^{H3} I became aware that the trade which had originally collapsed in 1993 had blossomed forth stronger than ever and was being sold at prices which could only be justified if the end-product was being sold for human consumption. This was freely admitted by Norman Swan's Adelaide interviewee. Armed with this new information, I totally disregarded the Adelaide human nutritionist's 1993 airport advice and published a second piece of correspondence^{H4} in *Nature* on July 15 1999 entitled: "Covert trade in toxic vetch continues."

Back to Canberra

Thanks to some prodding by a concerned S.A. farmer (Peter Groeke), Pulse Australia and AQIS set up a phone hook-up (Dec 16 1998) including myself to discuss the problem. The outcome was that after an approach to the relevant Minister (Mark Vaile), both vetch and lentils were decreed to be "prescribed grains" by amending the appropriate legislation in April 1999^{H5}. This now means that every batch of vetch or lentils for export must be inspected and must carry a phytosanitary certificate in which the correct botanical descriptor is in place. If the sale price per tonne is at a substantial premium to the price of stockfeed (lupins) it is a good indicator that it is being sold for human consumption. It is now much easier to monitor where all the vetch exports are going and for what purpose.

The Caveat emptor counter: Educate the Consumer by the Internet.

With the Sri Lankan experience, I suddenly realised that we had already found a counter measure to the "buyer beware" attitude of both our bureaucracy and the exporters. All that was necessary to empower overseas consumers, was to provide them with background information as well as Dr. Premakumara's simple qualitative thin layer chromatographic protocol on the vetch website of my former student Dirk Enneking at (<http://www.general.uwa.edu.au/u/enneking/VETCH.htm>). With this information any reasonably intelligent chemistry student anywhere in the world (with web access) could monitor the vetch/lentil substitution racket, no matter whether it was sourced from Australia or elsewhere. In Bangladesh alone for the year 1998/99 over 9000 mt were imported from Australia. This is sufficient to provide 90,000,000 x 100g platefuls each with at least 0.5g (half a teaspoon) of the thermostable toxin when it is cooked without leaching in the same manner as lentils.

Pakistan's Army is Not Fond of Vetch, Neither is Bangladesh.

In June 1999, I received "lentil" samples from a former Waite student, Dr. Habib Khan who works with Dr. Bashir in the Pulses program at NARC in Islamabad. They were simply labelled "a" and "b" and again it was clear from the IR that sample "b" was vetch. Unfortunately for a Pakistani importer, he had submitted "b" as a lentil sample, in a contract to supply lentils for the Pakistani army!^{H6} I was also able to receive samples from Dhaka colleagues at the World Bank and also from the Bangladesh Agricultural Research Institute which confirmed that vetch was being widely sold in the markets as either Indian Masur (Indian lentil) or "imported" Masur.

Shortly after I had analysed the Bangladeshi samples, on Sunday, September 26 1999, I received a visit from Dr. Quazi Faruque Ahmed of "Proshika", a Bangladeshi Non Government Organisation, with extensive offices throughout the country. Dr. Ahmed was astounded at the situation and as he left with a folder documenting the background to the vetch substitution racket, he declared it was his intention to shut down the importation of Australian vetch into Bangladesh. This was not a simple task, but he spoke with considerable confidence in the knowledge that he had previously forced a change of attitude on the part of SHELL to some of its operations in Bangladesh. Within a matter of six weeks Proshika had banned "lentil" consumption in all its canteens and held a prime time television conference and thereby prodded the government into acting. A "freeze frame" from

that TV conference revealed a bag labelled "Vetch" (In English, and being sold in a country with barely 10-15% literacy in English). The Bangladeshi word for common vetch is HATKE. The bag had been sold by the company of one of my inquisitors at the March 30 1993 Ceres enquiry!

News Suppression and the Law of Unintended Consequences.

Just as with the Sri Lankan episode, this was headline news in every newspaper in Bangladesh including an incisive cartoon^{H7}, but again not a vestige of information appeared in any Australian paper. Again, as in the unfortunate outcome in Sri Lanka, and because of the consumer's difficulty in distinguishing one from the other, both Australian genuine lentils as well as vetch were banned by the Bangladeshi government. The motivation for vetch/lentil substitution, so clearly proclaimed in the 1993 fax from the Grains Council of Australia to the ABC^{D3}, had come back to haunt Australia's promising lentil industry which was nonexistent in 1993. Here is a perfect example of the law of unintended consequences leading to the good being driven out with the bad.

It so happened that on Sat., October 16 1999, I learnt of the Bangladesh ban on Australian vetch imports. I was also aware that Sheik Hasina the Prime minister of Bangladesh was to visit Canberra on a State visit the following Wednesday. To avoid a potentially embarrassing situation, I faxed the Prime Minister's Department in Canberra on October 18 with the relevant documentation. The reply (Nov. 23 1999)^{H8} indicated that Sheik Hasina was extremely diplomatic and the topic did not arise.

In 1992 I was told that lentils would never be a viable crop in Australia. Now thanks to the release of selected lines which are adapted to the SA and Victorian environments, the genuine lentil industry is a burgeoning and profitable industry. Its very success was the subject of a recent ABC Landline program (<http://abc.net.au/landline/stories/s99108.htm>). In this program it was mentioned production had reached 75,000mt. The banning of genuine lentils by importing countries, because of the unethical practises of a few vetch exporters, has now become a real problem. Nevertheless, is not suited to all the cereal areas where vetch grows exceedingly well.

Closure After Disclosure? Amen To All That.

On April 2 2000, I phoned Gavin Gibson, C.E.O of Pulse Australia, the main Australian pulse industry organization and advised him that, one of the websites linked to that of Pulse Australia, was still promoting the sale of oil polished split Blanche fleur vetch.

He forwarded a copy of a memo^{H9} on April 27 2000, the key section reads:

Re: Vetch / Lentil Substitution Issue

There is at present no identified legitimate market for vetch in human food. It would be reasonably safe to assume that any export order received for vetch, requiring it to be split and polished, could be used eventually as an illegitimate substitute for lentils.

Unfortunately as at May 5 2000, a linked website was still offering oil polished split Blanche fleur vetch to the world. It does not bode well for the future.

Conclusion: Disclosure or Non Disclosure?

After reading De Maria's 1999 book entitled "Deadly disclosures: whistleblowers and the ethical meltdown of Australia."^{H10}, I believe it was exceedingly fortunate my own testing time in December 1991, came towards the end of my career, when I was in a virtually impregnable position as a tenured Head of the Dept. of Agricultural Biochemistry at the Waite Agricultural Research Institute of the University of Adelaide. Such ethical dilemmas (Disclosure or Non disclosure) and susceptibility to repercussions are obviously a function of age and experience of the "discloser". Dr. DeMaria includes an interesting Whistleblower's Circuitry Diagram^{H10}. readers can readily see that the Vetch / Lentil episode is now on the second lap of the perimeter.

De Maria has put forward the hypothesis that to be a true whistleblower, you must first to have suffered in some manner from your disclosure. In my own case the “suffering” was of a trivial nature, with the predictable public vilification, as a scientist who was perceived by industry to have made “unbalanced” and “irresponsible” claims. Fortunately this part of the edited original fax, was still readable when it was released by the Grains Council of Australia to the ABC on September 29 1992. This diatribe, was immediately followed by another edited, but readable sentence: “Blanchefleur vetch is a grain legume which produces an edible seed that competes with red lentils as a high source of protein.” The edited version of this sentence had replaced “red lentils” with “other legumes”^{D3}.

Failure To Learn From History Condemns You To Repeat It.

Thus, from the beginning, a naturally occurring lentil-seed mimic was used by an industry which ignored the chemical literature, and attempted to establish vetch as a cheap substitute for red lentils. This practice has now come back to haunt the Australian lentil industry today in the form of a recurrent vetch/lentil substitution scam. In 1992 in India, where the bulk of Blanche fleur vetch was initially being sold, the driving force was twofold. First, genuine lentils were being sold for US \$800/mt and Australian Blanche fleur vetch could be imported for approximately half this cost. Second, genuine lentils were receiving an export enhancement incentive from the Indian government. So it was not surprising that the Australian vetch imports and genuine Indian lentil exports to and from India were so popular. This is well documented in the Bhat and Raghuram Current Science article published in June 1993^{D6}.

In 1992 the chemical literature was ignored by industry; in 1999 it was deliberately disregarded. In both instances, the cost to Australia in both dollars and reputations all along the chain from funding body, to research worker, to farmer, to exporter and ultimately to the importing country has caused untold harm. The need in Australia for a vetch rotation in our dryer cereal areas is unquestioned. This means the potential **supply** of red split vetch is enormous. The other side of the supply / demand equation is the incredible third world **demand** for cheap high protein foods.

In the Vetch / Lentil saga, it is writ large that Australia badly needs a high yielding, near-zero toxin food-grade vetch with a distinct testa and cotyledon. Such a product must be such that it cannot be misrepresented as red lentil substitute. Just as Canola oil embodies the intelligent Canadian development of an excellent food product from the toxic wild rapeseed, so should Australia apply our talents to the production of a food grade vetch. Until such a commodity is produced and provides the farmer with better returns for his labour than Blanche fleur, it is absolutely predictable that this immensely profitable, but equally damaging and dishonest trade between an inexhaustible supply and an insatiable demand will continue.

I cannot forget those misguided parting words from the Adelaide “human nutritionist” and I sincerely hope I never have to: **“do that again”**. However, if needs be, I most certainly will.

Update (22nd June 2004).

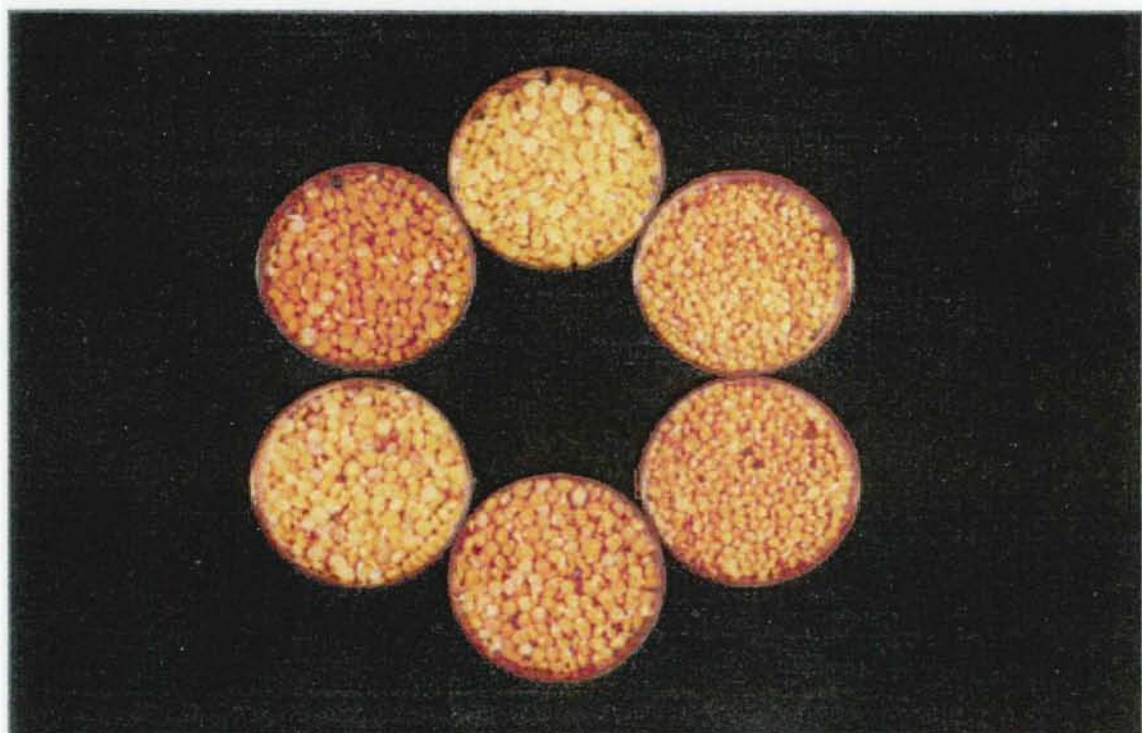
Legislative amendments by the Australian Government in Canberra (Commonwealth Gazette, 18th June, 2003) absolutely prohibit the export of split vetch from Australia, making it a criminal offence with a maximum of five years imprisonment.

In a more positive light, at the University of Adelaide’s Waite campus, with the help of Dr. Doza Chowdhury, we have undertaken the task of breeding a low toxin vetch, which suitable for animal feed. Progress has warranted the University’s registration of the generic trade name “LO-VET”. Hopefully “LO-VET” will one day be as well known to the world as CANOLA, bred by Canadian research workers from the toxic rapeseed plant.

Vetch/Lentil Substitution

A Cautionary Tale of Chemical Ignorance and Bad News Suppression

APPENDICES



Australian Roulette

CLOCKWISE FROM TOP:

“BRAZIL” (OZ BLANCHE FLEUR) (*V. sativa* L)
INDIAN LENTIL (*Lens culinaris* Medik)
BANGLADESH LENTIL (*Lens culinaris* Medik)
BRAZIL LENTIL (*Lens culinaris* Medik)
CHINESE LENTIL (*Lens culinaris* Medik)
SYRIAN LENTIL (*Lens culinaris* Medik)

APPENDIX A

Extracts* & References:

A1*. Enneking, D. Giles, L.C. Tate M.E. & the Late Davies R.L, (1993) L-Canavanine: A Natural Feed-intake Inhibitor for Pigs, (Isolation, Identification and Significance), J. Science of Food and Agriculture 61, 315-325.

A2*. Enneking, D., Delaere, I.M. Tate, M.E. (1998) γ -Glutamyl-S-Ethenyl-Cysteine: A dipeptide from *Vicia Narbonensis*, Phytochemistry, **48**, 643-646.

L-Canavanine: A Natural Feed-Intake Inhibitor for Pigs (Isolation, Identification and Significance)

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(Received 14 February 1992; revised version received 10 December 1992; accepted 26 January 1993)

Abstract: A major feed-intake inhibitor for pigs is present in seeds of *Vicia villosa* spp *dasycarpa* Roth cv Namoi. When the seed is fed for 4 days at only 80 g kg⁻¹ of the diet, it produces a steady diminution in daily feed intake to 25% or less of their pre-treatment consumption ($P < 0.001$), after the first feeding. The inhibitor has been isolated and identified as L-canavanine. When analytically pure L-canavanine dihydrochloride is supplied at an equivalent dietary concentration (13.0 mmol kg⁻¹) to that supplied by 80 g kg⁻¹ of Namoi vetch seed, it successfully mimics the response. The response is only observed after the first meal. A review of published literature showed the diversity of animal species exhibiting a feed-inhibition response to canavanine-containing seeds. These reports suggest that this well-documented arginine analogue will be a useful molecule for the study of post-ingestion feed-intake regulation. An ambient temperature procedure for the large-scale isolation of L-canavanine dihydrochloride is described.

Key words: canavanine dihydrochloride, deaminocanavanine, *Vicia villosa* *dasycarpa*, *Canavalia*, antinutritional factor, arginine analogue, feed-intake regulation, pigs, cattle, rodents, birds, monkeys, humans.

INTRODUCTION

As part of a programme to develop alternative grain legume crops for Australian agriculture, the aim of the present study has been to isolate and chemically identify a potent feed-intake inhibition factor for pigs, from seeds of the woolly pod vetch (*Vicia villosa* spp *dasycarpa* Roth cv Namoi). This vetch is a high-yielding forage plant and is of value in dry-land agriculture. However, *V. villosa* as forage can be toxic to cattle (Pancierra *et al* 1966), and its seed is toxic to poultry (Kienholz *et al* 1962 (and references therein)). The presence of toxic factors in the Leguminosae is well documented (Smolenski *et al* 1981; Rosenthal 1982). Their existence poses a significant end-

use constraint for the introduction of new grain legume and forage crops with otherwise desirable agronomic features. Nevertheless it must be noted that their elimination may result in the loss of agronomically desirable attributes such as resistance to insect attack (Rosenthal 1977a; Natelson 1985 (and references therein)). In either case, a knowledge of the chemical structures of these biologically active factors will permit a rational decision as to whether they, or the genes that produce them, should be eliminated, retained or transferred to other species.

Lepkovsky (1948) noted that 'the most frequent defence used by animals against toxic compounds is to limit their food intake so that the ingestion of the compound is reduced to non-toxic levels'. We have used this concept in the form of a pig feed-intake bioassay.

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γ -GLUTAMYL-S-ETHENYLCYSTEINE: A DIPEPTIDE FROM *VICIA NARBONENSIS*

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(Received in revised form 8 December 1997)

Key Word Index—*Vicia narbonensis*; Viciaeae; Narbon bean; γ -glutamyl-S-ethenylcysteine; photolabile; chemotaxonomy; non-protein amino acid; off-flavour precursor; grain legume.

Abstract— γ -Glutamyl-S-ethenylcysteine has been isolated and crystallised from aqueous ethanolic extracts of the seeds of Narbon bean, (*Vicia narbonensis*). The γ -glutamyl peptide is present at 0.7% in the Australian Temperate Crops Collection cultivar ATC 60105. Depending upon genotype and environment, seeds with up to 3% peptide have been observed. This photolabile peptide is the precursor responsible for the repulsive odour of germinating Narbon beans. It is a useful chemotaxonomic character for Viciaeae, as well as a significant storage form of seed sulfur. © 1998 Elsevier Science Ltd. All rights reserved

INTRODUCTION

In general, legumes are usually deficient in sulfur-containing amino acids [1]. The Narbon bean, (*Vicia narbonensis*) is an exception, with an extractable total sulfur content of ca 0.1–0.2% (dry wt) of the seed. It is, used in some societies for human consumption, is a minor Mediterranean grain legume and forage crop, with good adaptation to southern Australian dryland farming systems [2].

The sulfur containing γ -glutamyl peptide described in this paper was initially observed in extracts of Narbon bean during an investigation of antinutritional factors in *Vicia* species using a porcine feed intake bioassay (Enneking, D., personal communication). It appeared as a strong UV (254 nm) absorbing ninhydrin-positive spot on paper electrophoretograms of ethanolic extracts. It shows the electrophoretic characteristics of the chemotaxonomic character previously reported by Bell and Tirimanna as VA₃ in *V. narbonensis* [3]. Structural assignment was based upon its elemental analysis, electrophoretic-charge properties and spectroscopic analysis. These data are consistent with a γ -glutamyl derivative of S-ethenylcysteine. The absolute molecular structural configuration of the two chiral centres and confirmation of the γ -glutamyl substituent sequence are the subject of an X-ray crystallographic study. S-Ethenyl cysteine, the non-protein amino acid moiety of the

peptide, again of uncertain chirality, has been previously reported as a component of *Olex phyllanthi* [4].

RESULTS AND DISCUSSION

Seeds were extracted with 30% ethanol and examined by paper electrophoresis to reveal a previously uncharacterised cationic (pH 1.76), ninhydrin-positive, Ehrlich-positive, UV absorbing spot, with an electrophoretic mobility which was intermediate between γ -glutamyl- β -cyanoalanine [5] and glutamic acid. Irradiation of the air-dried electrophoretogram with UV light (254 nm) yielded a strong sulphurous odour from the UV absorbing band, which was similar to that from the germinating seed. A similar repulsive odour is observed when *O. phyllanthi* leaves are crushed.

The unknown non-protein amino acid was isolated and its structure established in the following way. Paper electrophoresis consistently showed a ninhydrin-positive spot with relative mobilities towards Orange G (RM O.G = -0.43, pH 1.7; RM O.G = +0.74, pH 5.0) indicating its suitability for isolation by anion-exchange chromatography. The relative electrophoretic mobility/pH behaviour is similar to that of γ -glutamyl- β -cyanoalanine [5] and is consistent with the presence of a γ -glutamyl- α -amino acid dipeptide, exhibiting two carboxyls with two overlapping pK_a values near 2.1 and 3.7. The alternative α -glutamyl- α -amino acid dipeptide would be expected to have two overlapping pK_a values near 3.0

* Author to whom correspondence should be addressed.

APPENDIX B

Extracts* & References:

B1*. Ressler, C. (1962) Isolation and identification from common vetch of the neurotoxin β -CN-alanine, a possible factor in neurolathyrism. J.Biol. Chem. **237**, 733-735.

B2. Ressler, C., Giza, Y. H., Nigam, S.N., Nelson, J. (1963) Isolation and identification from common vetch of γ -Glutamyl- β -cyano-L-alanine, a bound form of β -cyano-L-alanine. J. Am. Chem. Soc. **85**, 3311-3312.

B3. Ressler, C. (1964) Neurotoxic amino-acids of certain species of *Lathyrus* and vetch. Fed. Proc. **23**, 1350-1353.

B4*. Ressler, C. (1967) Metabolism of β -cyano-L-alanine. Biochem. Pharmacol. **16**, 2309-2319.

B5*. Ressler, C., Giza, Y. H., Nigam, S.N. (1969) Toxic principle in vetch. Isolation and identification of γ -L-Glutamyl- β -cyano-L-alanine from common vetch seeds. J. Am. Chem. Soc. **91**, 2758-2765.

B6*. Pfeffer, M. Ressler, C. (1967) β -cyano-L-alanine an inhibitor of rat-liver cystathionase. Biochem. Pharmacol. **16**, 2299-2308.

B7*. Sasaoka, K., Lauinger, C., Nigam, S.N. Ressler, C. (1968) γ -Glutamyl- β -cyano-alanyl-glycine, a metabolite of β -cyano-L-alanine in the rat and chick. Biochimica et Biophysica Acta **156**, 128-134.

Isolation and Identification from Common Vetch of the Neurotoxin β -Cyano-L-alanine, a Possible Factor in Neurolathyrism* B1

CHARLOTTE RESSLER

WITH THE TECHNICAL ASSISTANCE OF HILDA MALODECZKY

From the Division of Protein Chemistry, the Institute for Muscle Disease, Inc., New York 21, New York

(Received for publication, August 1, 1961)

Neurological effects have for centuries been observed to accompany in many instances the consumption of excessive amounts of lathyrus meal as food, particularly in parts of India and in the Mediterranean area in times of food scarcity. This condition, which is known as spontaneous clinical neurolathyrism, occurs chiefly in the male and is characterized principally by reflex irritability, weakness, spasticity, and rigidity of the leg muscles, followed sometimes by death (1). The etiology of lathyrism is unknown. However, the condition has been variously ascribed to a nutritional deficiency and to the presence of a neurotoxin in the lathyrus plant. Many studies in experimental lathyrism were made possible by the isolation of a lathyrus factor from *Lathyrus pusillus* (singletary pea) (2) and *Lathyrus odoratus* (sweet pea) (3-5), the identification of this factor as β -N-(γ -L-glutamyl)-aminopropionitrile, and the recognition of β -aminopropionitrile as the active principle of the factor.¹ However, the experimental condition produced with either the *odoratus* factor or with a number of synthetic compounds related to β -aminopropionitrile has resulted chiefly in abnormalities of bone and mesenchymal tissue in contradistinction to human lathyrism which is neurologic in character.¹

Recently, in an investigation of a new reaction encountered in peptide synthesis, which involves conversion of asparagine to γ -diaminobutyric acid (9), the amino acid nitrile, β -cyano-L-alanine, was synthesized (10). The latter was shown to be a likely intermediate in the conversion, arising through dehydration of the amide group of asparagine, and forming α , γ -diaminobutyric acid through reduction of its cyano group (10). Structurally, β -cyano-L-alanine also represents the parent amino acid which by biological decarboxylation could form the lathyrigen β -aminopropionitrile. In view of the latter relationship and the prevalence and importance of biological decarboxylation reactions, β -cyano-L-alanine was tested for possible neurological activity. Fed at the 1% level, this amino acid nitrile is neurotoxic to the rat, and within 3 to 5 days it results in hyperirritability, tremors, convulsions, and death (11). The D isomer at approximately 3 times the dose is also neurotoxic.² In contrast,

γ -cyano-L- α -aminobutyric acid, the amino acid nitrile which represents the dehydration product of L-glutamine (10), is tolerated with no obvious toxicity.²

These results led us to consider the possibility that β -cyano-L-alanine may be the neurolathyrigen which occurs naturally. Since Lewis *et al.* (12, 13) and Schultert and Lewis (14) had shown the seeds of two species of lathyrus, *i.e.* *Lathyrus latifolius* (perennial sweet pea) and *Lathyrus sylvestris Wagneri* (flat pea), to be neurotoxic to the rat and the mouse, we examined these seeds for the presence of β -cyanoalanine. These studies led recently to the isolation of the chief neurotoxic principle of *L. latifolius* and its identification as L- α , γ -diaminobutyric acid (11). This same amino acid occurs in very high concentration in the toxic seed of *L. sylvestris Wagneri* (11). It is perhaps more than fortuitous that although the isolated neurotoxin was not the sought-for β -cyanoalanine, it is, nevertheless, chemically related to the latter, L- α , γ -diaminobutyric acid being a reduction product of β -cyano-L-alanine. For this reason, and in analogy with the chemical reaction found with peptide asparagine, a biosynthetic pathway in lathyrus was considered likely in which L-asparagine is dehydrated to β -cyano-L-alanine. In *L. odoratus* this intermediate amino acid nitrile would be decarboxylated to yield β -aminopropionitrile, whereas in *L. latifolius* and *L. sylvestris Wagneri* it would be reduced to L- α , γ -diaminobutyric acid (11).

It appears that, in human neurolathyrism, one of the chief species of lathyrus involved has been *Lathyrus sativus* (15, 16). Yet, it has been found that consumption of the latter by experimental animals has not produced toxic effects (12, 17, 18).¹ A botanical examination carried out some years ago with a number of samples of *L. sativus* collected from various localities in India, where lathyrism was common, showed that in all the samples a leguminous weed, *Vicia sativa*,³ was present (18). Moreover, ducks and monkeys fed diets containing *V. sativa*³ developed a syndrome suggestive of deleterious effects on the nervous system. It was pointed out that the seeds of *L. sativus* itself are harmless, but that the danger of the disease lay probably in the contamination of the latter with other peas known

³ Identified as *Vicia sativa* L. var. *angustifolia* (18). Because *Vicia angustifolia*, which is regarded as the progenitor of *Vicia sativa*, was not available to us at the start of this study, we have investigated chiefly the latter which is considered to differ scarcely from the former except in dimensions (19).

This investigation was supported by a grant from the Muscular Dystrophy Associations of America, Inc.

¹ For reviews of the subject of experimental and clinical lathyrism, see references (6-8).

² C. Ressler, unpublished experiments.

MORRIS PFEFFER and CHARLOTTE RESSLER

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METABOLISM OF β -CYANOALANINE*†

CHARLOTTE RESSLER, JEANNE NELSON and MORRIS PFEFFER

Division of Protein Chemistry, Institute for Muscle Disease, Inc., New York, N.Y., U.S.A.

(Received 24 March 1967; accepted 16 June 1967)

Abstract—The cystathioninuria induced in the rat by feeding it L- β -cyanoalanine (BCNA) has been investigated further. The excreted cystathionine was isolated in crystalline form and established as having the LL configuration. The protective effect of pyridoxal also was examined, especially in relation to evaluating BCNA as an inhibitor of vitamin B₆. β -Cyanoalanine and a series of relevant compounds, including known inhibitors of vitamin B₆ and structurally related lathyrus toxins, were fed to rats for prolonged periods. Of these, BCNA alone elicited cystathioninuria, and this was not reversed by the administration of pyridoxal. β -Cyanoalanine produced no physical signs of B₆ deficiency or of osteolathyrism. In contrast to B₆ deficiency, the tryptophan-load test was negative and tissue concentrations of cystathionine were low. Brain, liver, blood, and muscle contained free BCNA and a new bound form of it, γ -glutamyl- β -cyanoalanylglycine, which may be a detoxication product.

SEEDS of certain species of lathyrus and vetch, used as forage or consumed in excess as food by humans in times of shortage, have been known to cause neurotoxicity.^{1, 2} In connection with a series of investigations of the toxic principles of such legumes, β -cyanoalanine and the dipeptide, γ -glutamyl- β -cyanoalanine, were isolated from seeds of *Vicia sativa* (common vetch) and found to account for the high toxicity of these vetch seeds to the chick.^{3, 4}

β -Cyanoalanine produces convulsions and rigidity when fed to or injected into the rat or chick. Attempts to reverse or prevent the convulsions in the rat with anti-convulsants of known central nervous system activity have been ineffective.⁵ Injected pyridoxal, however, does afford some protection against a single dose of β -cyanoalanine.⁶ Moreover, the rat that has been fed β -cyanoalanine excretes cystathionine,⁶ a condition previously induced experimentally only by the administration of a vitamin B₆-deficient diet.^{7, 8} These observations led us to suggest in a preliminary communication that β -cyanoalanine may be a naturally occurring vitamin B₆ antagonist or an antienzyme, possibly in the transulfuration reaction that converts methionine to cystine via cystathionine.⁶ Inhibition of the B₆-requiring step⁹ that converts cystathionine to cystine could lead to accumulation of cystathionine. It seemed of interest to investigate the action of β -cyanoalanine, especially since excessive excretion of cystathionine has been observed in patients with neural adrenal tumors¹⁰ and in individuals with the inborn error of metabolism, cystathioninemia.^{11, 12} The present

* Aided by U.S. Public Health Service grant NB 04316 and by Muscular Dystrophy Associations of America.

† Presented in part at the symposium "Antinutritional Factors in Vegetable-Protein Foods and Their Elimination," 25th Annual Meeting of the Institute of Food Technologists, Kansas City, 1966.

Toxic Principle in Vetch. Isolation and Identification of γ -L-Glutamyl-L- β -cyanoalanine from Common Vetch Seeds. Distribution in Some Legumes^{1,2}

Charlotte Ressler, S. N. Nigam, and Y.-H. Giza

Contribution from the Division of Protein Chemistry, Institute for Muscle Disease, Inc., New York, New York 10021. Received October 16, 1968

Abstract: γ -Glutamyl- β -cyanoalanine has been identified in seedlings and seeds of common vetch and isolated from the seeds in crystalline form after electrophoresis or anion-exchange chromatography. Its structure has been confirmed by synthesis. For this a mixed anhydride procedure and protecting groups that were removed by hydrogenolysis were used. The α isomer, α -glutamyl- β -cyanoalanine, also has been synthesized and differs in its properties from the naturally occurring peptide. γ -Glutamyl- β -cyanoalanine is neurotoxic to the young rat and chick. Together with the β -cyanoalanine present in the free state, it can account for the toxicity of common vetch seeds to the chick. Among seeds of 41 various legumes that have been surveyed quantitatively, β -cyanoalanine is present in every variety of common vetch and in approximately one-third of the vetch species and is accompanied by β -cyanoalanine in bound form.

During a study of a metabolic relationship between β -cyanoalanine and asparagine in certain species of *Lathyrus* and vetch, L- β -cyanoalanine-4-¹⁴C was administered to seedlings of *Vicia sativa* (common vetch).^{3,4} Radioactivity accumulated as unidentified, soluble, acidic material. Since all other plants examined converted β -cyanoalanine-4-¹⁴C into asparagine, the ¹⁴C-labeled vetch material was investigated with the hope of identifying a biological intermediate in the synthesis of asparagine. With the Birch reagent the material was found to be reducible to bound 2,4-diaminobutyric acid.⁵ Such behavior suggested the presence, for the first time, of a natural bound form of β -cyanoalanine. The labeled, reducible material was purified by electrophoresis and chromatography on paper. Hydrolysis converted it into glutamic acid and aspartic acid, which suggested that the administered β -cyanoalanine had been incorporated as a peptide of glutamic acid. Bound β -cyanoalanine was then detected in seedlings that had received no β -cyanoalanine-¹⁴C, and the β -cyanoalanine peptide was identified electrophoretically in seeds of the same plant in which it accompanies β -cyanoalanine in the free state.

Identification of a second form of β -cyanoalanine in common vetch seeds had further interest in view of the neurotoxicity of this amino acid.⁶ In addition to their use as cover crops, vetches have had use in livestock and human nutrition⁷ and represent a potential source of food in times of shortage. Moreover, common vetch seeds of a closely related variety contaminating wheat and lathyrus peas have been associated with several outbreaks of lathyrism in man.^{6,8,9} This paper presents in detail the

isolation from common vetch seeds of γ -L-glutamyl-L- β -cyanoalanine in crystalline form, its characterization, and its chemical synthesis, as well as the preliminary evidence leading to its detection. Feeding experiments carried out with the chick suggest that β -cyanoalanine and γ -glutamyl- β -cyanoalanine can account for the toxicity of common vetch seeds to this species. The role of γ -glutamyl- β -cyanoalanine (or β -cyanoalanine) in certain legumes as a major product of cyanide fixation and as an intermediate in the biosynthesis of asparagine from cyanide is presented in the accompanying paper.⁴ Part of this work has been previously reported.¹⁰

Results and Discussion

Although young seedlings of common vetch were far superior with regard both to the concentration of glutamyl- β -cyanoalanine and the number of contaminants that had to be removed, seeds were chosen as the starting material for the isolation of the dipeptide¹¹ because they were available commercially. The distribution of acidic material was noted with the R_f and electrophoretic mobility established for glutamyl- β -cyanoalanine-¹⁴C in the preliminary metabolic experiment. Presence of bound β -cyanoalanine was confirmed by reduction.⁵

Material in aqueous ethanol seed extracts was adsorbed on Amberlite CG-120 (H^+ cycle) cation-exchange resin. That which eluted early with 3 *N* NH_3 was electrophoresed on blocks of Solka-floc in pyridinium acetate buffer, pH 5.7. An acidic fraction was then reelectrophoresed at pH 3.5; this enabled the glutamyl- β -cyanoalanine to be separated from aspartic acid and glutamic acid, the chief acidic contaminants. The eluted peptide was isolated and characterized as a crystalline dicyclohexylammonium salt. Amino acid analysis¹² showed 1 mol each of aspartic acid, glutamic acid, and NH_3 . In the analysis for bound β -cyanoalanine⁵ 1 mol of glutamic acid was present, and

(1) Aided by Grant NB 04316 from the U. S. Public Health Service and by Muscular Dystrophy Associations of America.

(2) Presented (a) at the 145th National Meeting of the American Chemical Society, New York, N. Y., Sept 1963 (Abstracts, p 4A), at the Symposium on Deleterious Compounds of Natural Origin in Foods and Feeds, and at the Third Conference on Toxicity of Cycads, Chicago, Ill., April 1964.

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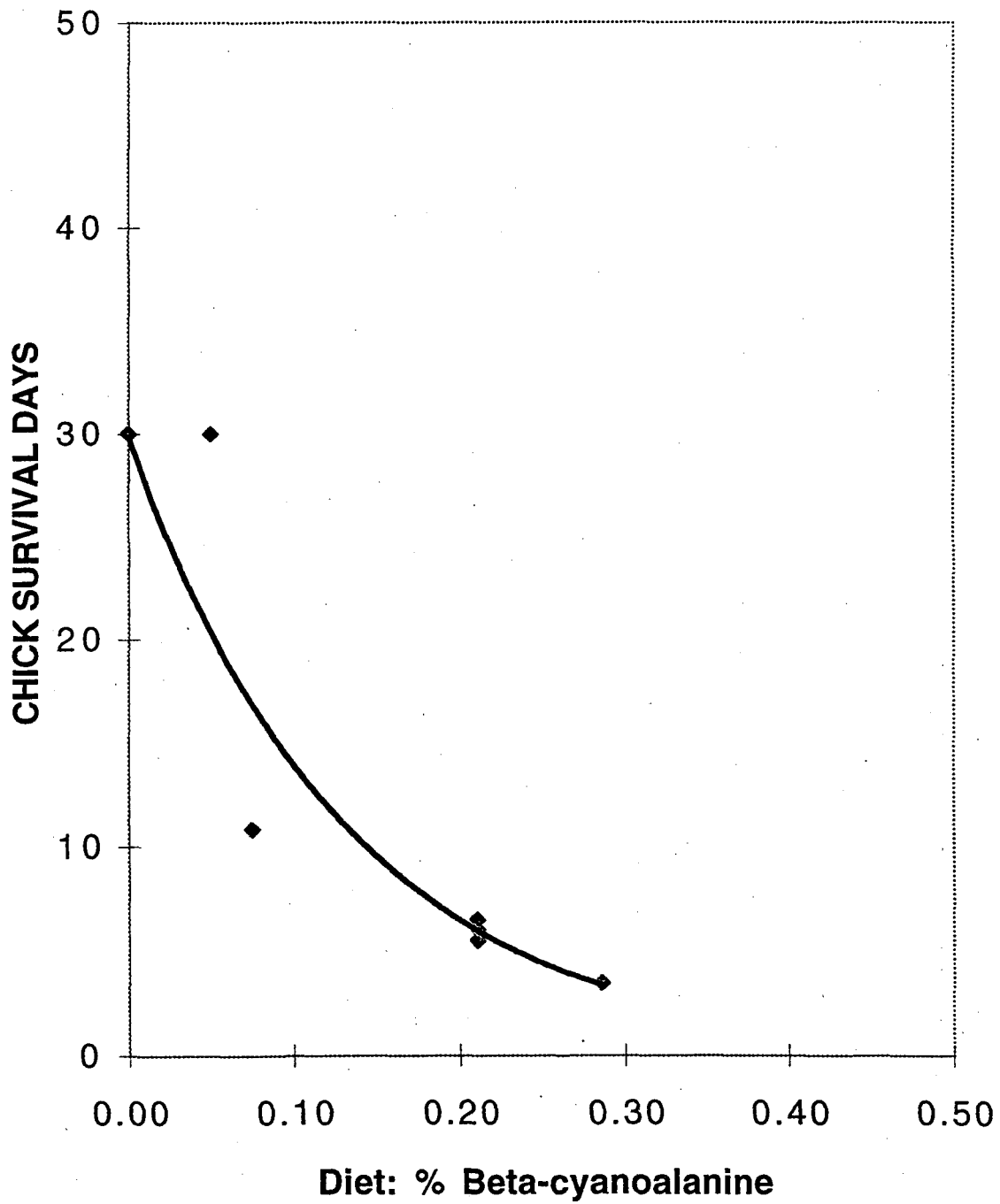
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APPENDIX C

Extracts* & References:

C1*. M. Robbins (Australian Quarantine Inspection Service) FAX February 11 1992

C2*. Don Marshall "Lumen" 1987, Vetch exports, Adelaide Advertiser October 30 1991

C3*. A. Griffiths MHR Canberra Reply March 25 1992.

C4*. P.R. Staples MHR Canberra Reply September 15 1992.

Your ref: W0082
Our ref: Mr Robbins
Expiry: February F1, 1992

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY,
AUSTRALIAN QUARANTINE AND INSPECTION SERVICE, W.A.

C1*.

17 FEB 1992

CIRCULAR TO EXPORTERS

FALSE TRADE DESCRIPTION - EXPORT OF VETCH *VICIA SATIVA* DESCRIBED AS LENTILS

The Australian Quarantine and Inspection Service (AQIS) has recently stopped the export of split vetch falsely described on bags and in documentation as lentils. Some exporters were marking bags of split vetch with the description "Red Split Lentils" or "Masoor Whole" (Hindi word for Lentil).

Many varieties of vetch contain toxic amino acids, such as beta cyano -l-alanine, making them unsuitable for human consumption. The recently released variety "Blanche Fleur" is suitable for human consumption and in its split form has a similar colour, shape and size as lentil. However, consumer acceptance of this vetch as an alternative food source has been slow.

Lentil is a staple food source in India and many Middle Eastern countries and maintains a high price on the world grain markets. It has become apparent that some exporters have for some time been falsely describing split blanche fleur vetch as lentil.

False trade description is of considerable concern to AQIS and the Export Control Act (1982) contains penal provisions. AQIS policy is; that whenever a trade description is used it must be adequate and accurate. For this reason, the use of the word "lentil" to describe split blanche fleur vetch is both misleading and inaccurate.

AQIS Central Office has consulted with the exporters and the Grains Council of Australia and has settled on suitable terminology to describe the commodity adequately and accurately.

The following names are acceptable:

Red Split Legumes
Red Split Dhal
Australia Red Dhal
Vetch
Blanche Fleur
Blanche Fleur Vetch

When preparing Phytosanitary Certificates for this commodity the following conditions apply.

1. If bags are branded as "Split Red Legume", "Red Split Dhal" or any other acceptable name, then this wording must be shown on the phytosanitary certificate under distinguishing marks.
2. The name of the produce can be shown as vetch, or ruled through.
3. The botanical name must be shown. Blanche Fleur vetch can be described as *Vicia sativa* or as *Vicia sativa* Cv Blanche Fleur.
4. If bags are branded with a foreign language or wording that the inspection officer does not understand, it will be the responsibility of the exporters to provide a verified translation of its meaning prior to inspection.

M.L. Robbins

(M.L. Robbins)
SUPERVISING INSPECTOR (EXPORT CONTROL)

Waite Chair of Agronomy appointed

C2*.

Professor Donald Marshall has been appointed to the Waite Chair of Agronomy at the Waite Agricultural Research Institute.

He took up his appointment in early January, ready for the start of the 1987 financial year.

Professor Marshall comes to Adelaide from the position of Director of the International Association on Wheat Research Centre, University of Sydney, Plant Breeding Institute, Narrabri.

He is a graduate of the University of California, where he completed his graduate degree, and of the University of California, where he received his doctorate.

He also worked with the C.S.I.R.O. as an Elizabeth II Research Fellow and as Leader of the Genetics Resources Unit of the Division of Plant Industry, a position he held from 1971 to 1981.

His personal research studies have been concentrated on four distinct but

interrelated areas: plant population and evolutionary genetics, the estimation and evolution of mating systems in plants and their manipulation in breeding programs, co-evolutionary relationships between host plants and their fungal parasites and the collection, conservation and utilisation of plant genetic resources.

Professor Marshall has also been involved as a principal investigator in several applied breeding projects financed by industry funds and his more recent industry based projects have been concentrated in the area of wheat breeding and genetics.

He has an extensive publication record and an international reputation as a respected plant biologist.

Professor Marshall was the unanimous choice of the selection committee for the Waite Chair of Agronomy.

The Director of the Waite Agricultural Research Institute, Professor James Quirk, was enthusiastic in welcoming such an outstanding appointment.



Professor Donald Marshall

Potential for faba beans, but ... Vetch export market may be available

THERE is great potential for increased faba bean production in South Australia if only the industry can get its act together, says Riverton grower and UFS oilseed and protein crops committee chairman Trevor Day.

"Part of that is on-farm, in terms of looking after the disease problem and especially the grubs problem," Mr Day told Crop Science Society members last week. "Too many people are saying they will cut their costs a bit by not spraying the beans."

"But it's almost impossible to pull a bean with a grub hole in it out of a sample, and that's a major problem for buyers in the Middle East, because it usually ends up with a dark spot around it, especially if it is canned."

"A lot of their beans are eaten in canned form, and ascochyta blotch and grub holes are a real problem."

"Grubs can be controlled on the farm as can some of the diseases."

Mr Day said there were varietal lines from ICARDA that were resistant to ascochyta and chocolate spot in the gene pool at Waite Agricultural Research Institute and Waite plant breeder Dr Ron Knight had the ability to produce resistant varieties for local use. But his funding of \$40,000 a year virtually only covered the cost of a technician and a bit of travelling.

"We need a lot more motivation and push in that area to get our beans right,

BLANCHETLEUR vetch may have promising export potential in India and Sri Lanka as a human food, if government tests being done there confirm its acceptability, UFS oilseed and protein crops committee chairman Trevor Day said last week.

Reporting on a recent market study trip to both countries, he told a meeting of the Crop Science Society of SA at Roseworthy Campus that importers in both countries were very interested in the variety as a replacement for red lentils from Turkey.

"By splitting it and taking the skin away it looks just like red lentils," he said. "We have arranged for further samples to be sent over there for testing by their government laboratories to see if it's fit for human consumption as a lower cost replacement for red lentils, which they can only get from Turkey. They don't like having to buy from Turkey, and they don't like Turkish quality because it has 2 per cent admixture and 2 per cent fine seeds or other seeds."

"But like most places we went to, while they don't like the quality they get from Turkey or China, they said they would not pay any more for good quality (from another source)," he said.

"So the lowest quality will still set the market price, and price premiums will be very difficult to achieve."

FOOTNOTE: On grain legume price prospects, Mr Day said he felt there would be downward pressure on pea

The Advertiser
October 30
1991



C3*.

MINISTER FOR RESOURCES

The Hon. Alan Griffiths, MP

25 MAR 1992

Dr ME Tate
Reader in Plant Science
The University of Adelaide
Waite Agricultural Research Institute
Department of Plant Science
GLEN OSMOND SA 5064

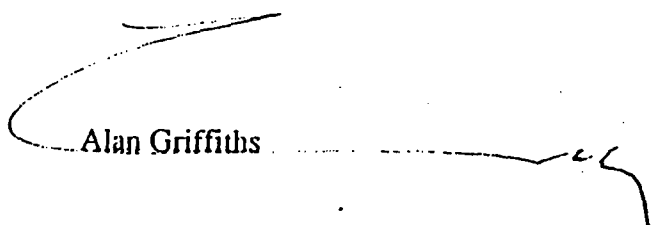
Dear Dr Tate

Thank you for your facsimiles dated 25 February 1992 and 5 March 1992 to the Hon Simon Crean, Minister for Primary Industries and Energy, concerning the suitability of the vetch cultivar Blanche Fleur for human consumption. As the matter raised falls within my responsibilities under the Primary Industries and Energy Portfolio, your letter has been passed to me for reply.

I am informed that you have raised your concerns with the Australian Quarantine and Inspection Service (AQIS) about the possible levels of beta cyanoalanine in the cultivar Blanche Fleur. I have also been informed that AQIS, in response to your facsimile, has informed the Grains Council, exporters and AQIS inspection staff that it is not possible to provide affirmation that the cultivar is fit for human consumption.

It will be a matter for the industry to establish to the satisfaction of competent authorities such as the National Food Authority that the levels of beta cyanoalanine in this or other cultivars render them fit for human consumption. AQIS would then take appropriate action on this advice.

Yours sincerely


Alan Griffiths

Ministerial Office:
Parliament House
CANBERRA ACT 2600
Tele: (06) 277 7480 Fax: (06) 273 4154

Electorate Office:
Shop 25 Milleara Mall
Milleara Road, EAST KEILOR VIC 3033
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Parliament House
Canberra ACT 2600
Telephone: (06) 277 7220
Facsimile: (06) 273 4146

Portfolio of
Health, Housing
and Community Services

C4*.

15 SEP 1992

Dr M.E. Tate
Reader in Plant Science
Waite Agricultural Research Institute
Department of Plant Science
The University of Adelaide
GLEN OSMOND SA 5064

Dear Dr Tate

I refer to your letter of 27 April 1992 to the Honourable A.G. Griffiths MP, in which you discuss your concerns regarding the use of untreated split red vetch for food. Your letter has been referred to the Honourable P.R. Staples MP, as Minister responsible for food matters. The Minister has asked me to reply on his behalf.

As you may be aware the Australian Food Standards Code prescribes standards for all foods. The States and Territories incorporate the Code into their food laws by reference. In addition, State food laws require that food which is sold to the public is fit for human consumption. This provision would cover natural toxins such as those present in vetches and defines food which may be injurious to health as 'adulterated'. State and Territory health authorities are responsible for ensuring compliance with the food laws in their respective jurisdictions.

In the case of a food such as vetch which has not been standardised, that food would still have to comply with General Standards (A1 to A14) of the Code. The General Standards cover topics such as labelling and advertising, among other issues. Under the labelling provisions it would be deemed illegal to label split vetch as split red lentils.

2.

Applications to set standards for new foods such as vetch can be made by individuals and groups. The National Food Authority sets food standards by drawing on the expertise of its staff and on information from the applicant, the food industry, government health departments, the public, consumers' associations, the National Health and Medical Research Council and the Australian Government Analytical Laboratories. If vetch was to be standardised in the Food Standards Code a limit on the level of cyanolanes allowable in food grade vetch would be determined. At present as no limit has been prescribed, no cyanolanes are allowed in vetch or indeed other foods intended for human consumption.

An application would need to be made to the National Food Authority to set a standard for a safe level of cyanolanes in vetches.

Yours sincerely

Chris Gratton
Advisor

APPENDIX D

Extracts* & References:

D1*. Tate, M.E Stock J. Letter April 9 1992

D1b*. Dr. John Radcliffe (Director S.A. Dept. Agriculture) Personal note April 10 1992.

D2*. Tate, M.E. and Enneking, D. (1992) A mess of red pottage, Nature **359**, 357-358.

D2R*. Nature Referee's Comments (Dr. P.M. Dey), July 14 1992.

D3*. McCallum, A (Chairman Grains Council of Australia), Kreital J. (Senior Economist) and Hooke, M. (Executive Director) FAX to ABC Sept 29 1992.

D4*. McCallum, A.D. (1992) Coping with Toxic pulses (Corres.), Nature **360**, 9.

D4b*. Brown, E.G. (1992) Coping with Toxic pulses (Corres.), Nature **360**, 9.

D5*. Putnam, D.H. Letter (December 3 1992).

D6*. Ressler, C. Letter (March 15 1993).

D7*. Bhat, R.V., Raghuram, T.C. (1993) Health and economic consequences of imported Toxic legumes. Current Science, **65**,12-13

D8*. Adelaide "Stock Journal" Article (April 29 1993), p13 Vetch ruled as unsuitable.

Letters

Letters should be clearly marked and addressed to The Editor, GPO Box 2245, GPO, Adelaide 5001. They can be posted or faxed to (08) 232 3110. Letters must be signed and include the sender's name and address and phone number for checking purposes. Shorter letters, between five and ten paragraphs, have a better chance of publication. The Editor reserves the right to cut letters for space or legal reasons or to use sections of long letters in the Quotes column.

Vetch toxicity is possible

SIR — Re Vetch Toxins (Stock Journal March 26).

I and my student Mr Dirk Enneking have been studying the biological chemistry of vetch toxins here at the University of Adelaide's Waite Agricultural Research Institute for the last three years.

Late last year my student was approached by an industry source anxious to explore the export potential of the Vicia sativa cultivar known as Blanche Fleur (literally white flower) for human consumption.

The scientific literature as far back as 1969 recorded that American cultivars of Vicia sativa contained up to 0.6% of a neurotoxic peptide known as gamma-glutamyl-beta-cyano-alanine. Lesser amounts of the corresponding neuro-toxic amino acid beta-cyanoalanine were also found. These workers clearly showed that feeding diets containing 50% of this vetch or the equivalent amount of the purified neuro-toxin to week old chickens caused 100% mortality.

We have now confirmed, the presence of similar levels of glutamyl-beta-cyano-alanine in the Blanche Fleur cultivar. Unless a true value adding step of detoxification either by processing such as Australian aboriginals have done for acorns with cyano seeds to remove a similar neurotoxic aminonucleide (beta-N-methylamino-alanine) or alternatively genetic selection or deletion of the neurotoxin genes is undertaken, then under no circumstances can the Blanche Fleur cultivar be considered suitable for human consumption.

Nevertheless pigs will tolerate up to 10-15% of the Vicia sativa cultivars Blanche Fleur and Languedoc without the readily measurable symptom of reduced feed intake.

Clearly, Mr McPherson is in error when he says (Stock Journal March 26) that "Your (the Stock Journal) statement regarding neuro-toxicity is without foundation, and I have already advised him directly.

As grain legumes and forage crops, vetches have an important role to play in Australian agriculture especially as stock feed supplements and there are some excit-

LETTER OF THE WEEK

Vale, Dean Klitscher

Sir — I write regarding the tragic death of Dean R. Klitscher on April 2, 1992, the result of an accident.

The SA farming community will mourn the loss of one of its most worthy representatives.

Dean joined the SA Peagrowers Co-operative in 1982 as a Director, representing the Coonahlyn area.

ing prospects for the development of relatively non-toxic grain legumes for our drier areas.

Nevertheless, because the plants have successfully evolved a wide range of chemically based predator defence mechanisms, it is not very "clever" to ignore the well documented chemical literature in our haste to increase exports.

Dr Max E. Tate,
Reader in Plant Science,
University of Adelaide,
Waite Agricultural Research Institute.

Chemical spill suggestions

Sir — After attending a meeting of the local CFS recently I have been motivated to make the following comments.

The question of dangerous chemical spills from road tankers was raised and discussed at some length and the following was the conclusion reached.

The drivers of these trucks are apparently required by law to have the details of their load documented and these papers are to be carried in a pocket in the driver's side door.

It was considered quite feasible by some at this meeting that if the tanker had overturned or in some way been involved in an accident that someone approach the truck,

He was an enthusiastic member of the Board, a good debater and a sound thinker.

As a member of the Co-operative Marketing Committee, his effort and input was extremely valuable and all Co-op members received the benefit from it.

Dean was also a member of the Committee which produced the highly successful "Grain Legume Handbook".

Dean was always willing to pass on his valuable knowledge of farming prac-

tices to others and hundreds of farmers have benefitted from this unselfishness.

His untimely death will be a huge loss to the farming sector of this State as he represented farmers on numerous committees concerning grain production.

His family can be extremely proud of his achievements, both in agri-politics and at home as a seed producer and farmer.

Ian Ward,
Chairman, SA Peagrowers Co-operative)

crews something like this must be added, and preferably, very soon.

Bill Goodrie
Peterborough

In a serious economic mess

Sir — We are in a very serious economic mess. Why? Some of the main basic reasons are:

1. The absolutely ridiculous increase in prices (just a money grabbing exercise the Government).
2. Excessively high interest rates.
3. The wages policy, of the dog chasing tail outlook, that priced us out of the markets; and the general mismanagement of Government, and, in Keating's own words giving us the depression that we "had have".

Since we now know the cause of the depression, the only intelligent course of action is to reverse the procedure that got us in the mess. It really is as simple as that. If follow that procedure, and bring about a situation where business of all categories afford to employ labor, not only will the economy right itself, but a very large proportion of the unemployment that we now have will also disappear.

But that is something the Government will not look at or entertain. I venture suggest.

GR Shepherson
Wudin

Wool tax payback

Sir — In reading a letter to Editor Journal 2/4/92 from Robert Langlandsham, titled Forgotten Wool Losers.

I am one of those people, having farming and woolgrowing industry and have taxes due to me back to 1984.

I would suggest that the wool tax be raised so that all woolgrowers within the industry should have all taxes paid within one or two years of leaving the industry.

There has to be some policy in finalise the wool taxes to past woolgrowers.

GM
Port

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DEPARTMENT OF AGRICULTURE

INTERNAL MEMORANDUM

To D. Max Tate
Waite Institute

Docket Ref. _____

Date _____

Max

Just a note to congratulate you on the letter
from you published in the Stock Journal on
9 April 1992

This is the kind of definitive and quietly authoritative
correspondence which is needed from time to time in
issues like this, and in turn reflect well on
agronomical scientists in particular and the Waite
Institute in general

With regards

John Radcliffe

10.4.92

A mess of red pottage

D2*.

Max E. Tate and Dirk Enneking

The abundant *Vicia sativa* cultivar 'blanche fleur' from Australia is perceived by markets to be a cheap, protein-rich pulse, but is it suitable for human consumption?

ESAU sold his birthright to Jacob for a mess of red pottage, a dish thought to be the red lentil (*Lens culinaris* Medik)¹. Taking today's prices of US \$800 per tonne, this particular pulse must seem to be an attractive crop to many farmers. Unfortunately, red lentils are a rather poor-yielding crop, so in the late 1980s, when it was noted in Australia that the pinkish cotyledons of the 'blanche fleur' cultivar of *Vicia sativa* L. bore a close resemblance to those of the red lentil after dehulling, it was but a short step to the creation of a brand new food export market.

Work in Europe in the 1920s (summarized by Barulina²) established the virtual omnipresence of *V. sativa* as mimics of lentil crops. Flowers were eliminated as soon as they appeared because they are a different colour from *L. culinaris*. Lentil mimics still occur: proteins characteristic of seeds of a lentil-like vetch (*V. sativa*) have recently been detected as minor foreign matter in Manitoba lentil crops³. A European lentil-like vetch (*Vicia* var. *lentil sperma*) was of sufficient concern for the International Organization for Standardization to propose test methods for its identification in 1989.

So an uninformed consumer may well be duped by lentil look-alike vetches. The somewhat spherical cotyledons of *blanche fleur* more closely resemble those of the common yellow split pea (*Pisum sativum*) than the flatter appearance of the lentil, but the colour (especially when coated with vegetable oil to enhance its attractiveness) bears a distinct resemblance to a paler form of red lentils. It is this mimicry of the red lentil which lies at the heart of the *blanche fleur* story.

The *blanche fleur* cultivar of *V. sativa* has been a useful stock feed and green manure crop in Australia since the early 1950s, growing readily in the mediterranean climate of southern Australia. But it is now perceived to be a valuable food-export cash crop for farmers: the latest export figures for the state of South Australia alone show that the export trade has grown from a mere 50 tonnes of *blanche fleur* in 1988-89 to more than 9,470 tonnes from July 1991 to early May 1992. Of this latter figure, 5,600 tonnes were sold as split red vetch

('red legumes' or 'red dhal'), which must be destined for human consumption (because the added cost of splitting (dehulling) would make it non-competitive in the stockfeed market). There are also significant exports from other Australian states, so that these figures are underestimates of the true magnitude of the trade.

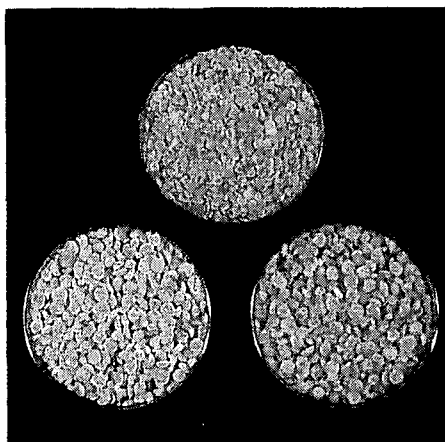
There are at least nine reports in the literature of the toxic effects of feeding untreated *V. sativa* to pigs, mules, horses, ducks, monkeys, turkey poult and chickens. Of particular note is the important neurotoxin study of Ressler *et al.*⁴. These authors established that a 50% *V. sativa* diet fed to week-old chickens caused all the animals to die in less than one week; the observed toxicity

So unless it is detoxified before eating, the split red vetch exported from South Australia alone is sufficient to provide 56,000,000 × 100-g servings, each of which, before preparation, contains up to 1 g of neurotoxins.

Alarming though the neurotoxin content of *V. sativa* is, the fact remains that people do not eat raw legumes but process them by, for example, dehulling, soaking and cooking with or without straining at intermediate stages. The analytical data from Victoria suggest that up to 90% of these water-soluble toxins can be removed by the age-old detoxification practice of leaching, which involves soaking the dehulled vetch and discarding the washings. In a separate experiment, approximately 30-50% of the toxin was removed by cooking. Nevertheless, it is as well to point out that these cooking experiments measured the loss of the original toxins, not whether there was loss of biological toxicity *in toto*. In this respect, Harper and Arscott⁵ established that extensive autoclaving (8 hours at 15 p.s.i.) of *V. sativa* was necessary substantially to reduce its toxicity to chickens.

Before the identification of the neurotoxin content, the sporadic use of white-seeded varieties of *V. sativa* as a pulse for human consumption has been reported^{6,7} and P. Hanelt (IPK, Gatersleben; personal communication) suggests that its consumption is still extant in the province of Racha in West Georgia (CIS). Hegi⁷ mentioned that 'sour lentil' (*V. sativa*) samples were confiscated by police in Berlin during the First World War and Danckwortt⁸ tabulated *V. sativa* as a poisonous vetch. Nevertheless, there does not seem to be any mention in this period of any unequivocal case of human poisoning that could be attributed to *V. sativa*.

The United Nations Food and Agricultural Organisation has a food quality and consumer protection group based in Rome which was apparently unaware of the widespread sale or human consumption of *blanche fleur* when we contacted it. A member of the group wrote that its view was that in countries where pulses are eaten, most toxins would be lost during the common culinary practice of soaking and discarding the washings. To us, the important point seems to be



Cotyledon mimicry of red lentils (*Lens culinaris*, upper) by commercial samples of the 'blanche fleur' cultivar (*V. sativa*). Lower left, split red vetch; lower right, the same product coated with vegetable oil to enhance its visual appeal.

could be quantitatively accounted for by the measured levels of L-β-cyanoalanine (0.1%) and its γ-L-glutamyl derivative (0.6%). In contrast to the acute toxicity in chickens, rats showed only a marked retardation in growth rate. So although there is considerable species variability, under no circumstances can untreated *V. sativa* be considered to be suitable for human consumption.

Analytical studies at the Australian Grain Academy in Victoria have established that the *blanche fleur* cultivar contains similar levels of β-cyanoalanine (0.1%) and perhaps higher levels (1.1%) of the γ-glutamyl derivative than those reported for *V. sativa* by Ressler *et al.*⁴.

whether or not the blanche fleur is likely to be treated as if it were red lentils. Red lentils frequently have only sufficient water added to produce the final desired consistency, thereby retaining as many of the minerals and vitamins as possible. With a red lentil mimic such as blanche fleur this practice would inevitably result in higher consumption of neurotoxins. With the almost ubiquitous presence of water-soluble (and in many cases thermostable) toxins in nearly all legumes, leaching by soaking is easy to recommend and practice, but in many regions of the world water is a scarce and valuable commodity.

Thus it would seem that in practice there is very little international monitoring of new commodities supplied for human consumption and there is great reliance on self-regulation by exporting countries. Presumably this is based on the premise that if mistakes are made, it is the financial profit and credibility of the exporter which suffers most — but in this particular case, there seems to be much less concern for the health of the consumer.

Lentils or vetch?

Is there any evidence that blanche fleur has been labelled as red lentils? In the past it has, as is documented in a letter to the *South Australian Stock Journal* dated 26 March 1992. The Victorian brokerage firm which negotiated the sales of the split red vetch to various buyers stated: "The first two shipments, a total of 400 tonnes were branded at the request of the overseas buyers as split red lentils, but described on the phytosanitary certificates as split vetch. All shipments since have been branded either split legumes or split red dhal."

It is obvious from this statement that not all the blame for this situation must rest with the exporter. Furthermore, the lack of background knowledge within this particular company is clearly evident in their comments in an earlier letter to the *Stock Journal*: "Your statement regarding neurotoxicity is without foundation. This is supported by the repeat orders we are now receiving from all our overseas buyers who have had almost three months to evaluate the quality of the product."

The department of primary industries and energy supervises AQIS, the Australian Quarantine Inspection Service, which issues the all-important phytosanitary certificate to exporters. It was a consequence of a request to us last year by a concerned South Australian exporter of blanche fleur that we commenced a qualitative paper-electrophoretic investigation, in which we clearly identified the presence of the unusual and characteristic blue ninhydrin spot of β -cyanoalanine in a sample of blanche fleur at a level similar to that in other *V. sativa* cultivars.

Much to our surprise, the exporter informed us in late in February this year that, contrary to our report of the presence of neurotoxins in blanche fleur, AQIS had issued a circular dated 11 February 1992 entitled "False Trade Description — Export of *Vicia sativa* Described as Lentils" in which it was stated: "Many varieties of vetch contain toxic amino acids such as β -cyanoalanine making them unsuitable for human consumption. The recently released variety Blanche Fleur is suitable for human consumption and in its split form has a similar colour, shape and size as lentil. However, consumer acceptance of this vetch as an alternative food source has been slow."

Our initial reaction was to be thankful for the common sense of consumers. But we then repeated and confirmed our earlier observations. The responsible minister was immediately notified of our concern on 25 February and again on 5 March, to which we received a reply on 25 March: "I am informed that you have raised your concerns with AQIS about the possible levels of β -cyanoalanine in the cultivar Blanche Fleur. I have also been informed that AQIS, in response to your facsimile, has informed the Grains Council, exporters and AQIS inspection staff that it is not possible to provide affirmation that the cultivar is fit for human consumption."

It will be a matter for the industry to establish to the satisfaction of competent authorities such as the National Food Authority that the levels of β -cyanoalanine in this or other cultivars render them fit for human consumption. AQIS would then take appropriate action on this advice."

Exporters have assured us that once a shipment leaves the wharf it can be sold and resold many times over, and hence the destination on the phytosanitary health certificate bears little relation to where it is eventually consumed. Nonetheless, the split blanche fleur from South Australia in 1991–92 was initially destined for Saudi Arabia, United Arab Emirates, Dubai, Oman, Jordan and Egypt. The whole vetch was consigned to Portugal, Italy, Spain, South Africa,

Austria and the United States. Re-export from the Middle East to India, Pakistan, Sri Lanka and other countries is highly likely.

What more can be done?

In the first instance, the consumers and the scientific community at large can be made aware that red vetch *V. sativa* is not the edible red lentil *L. culinaris* and that is the main purpose of this article. Second, the common practice of soaking pulses and discarding the washings substantially reduces the toxin level, and this should be encouraged. Third, cultivars with negligible neurotoxin content can be selected for by plant breeders, despite the probable decrease in yields that would result from insect or avian predation.

For those who wish to distinguish between these two look-alike pulses, the simple week-old chicken bioassay outlined by Ressler *et al.*⁴ would provide an inexpensive alternative to either HPLC analysis or the Canadian protein electrophoretic procedure, and would thus be feasible for use in poorer countries. Even on the scale of the Australian exports, there have been no reports of acute toxicity among consumers. It is therefore probable that any untoward consequences have gone unrecognized or are close to symptomless. Nevertheless, Ressler *et al.*'s observations on growth retardation by feeding *V. sativa* to immature rats provide a warning that one particular potential usage, as part of a free midday meal for schoolchildren in Sri Lanka, which was briefly suggested in a market-research report for the Australian Grain Legumes Committee in 1991, should be forbidden. And the indirect introduction of blanche fleur into famine-relief programmes should also be proscribed.

In a protein-deficient world it is possible that suitably leached or genetically altered and thereby detoxified cultivars of *V. sativa* may come to be important as human food, just as other crops at first regarded as undesirable have been modified for human consumption either by post-harvest processing (soyabeans) or by genetic improvement (rape seed). Meanwhile, in the absence of any satisfactory data on the toxicology of β -cyanoalanine and its γ -glutamyl derivative, everyone should be on their guard for the appearance of deleterious effects from the rising human consumption of the blanche fleur cultivar of *V. sativa* marketed as 'red vetch', 'red legumes' or 'red dhal'.

Max E. Tate and Dirk Enneking are in the Department of Plant Science, Waite Agricultural Research Institute, University of Adelaide, Glen Osmond, South Australia 5064.

NATURE · VOL 359 · 1 OCTOBER 1992

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Mr Tim Lincoln
News and Views Editor
NATURE
Macmillan Magazines Ltd.
4 Little Essex Street
London WC2R 3JF

July 14, 1992

Dear Mr Lincoln,

Thank you for your letter of 7th July regarding Dr. Tate's article which I read with great interest.

It is well known that Vetch (*VICIA SATIVA*) contains toxic substances and therefore, without any pretreatment this pulse is unsuitable for human consumption. It is also evident from the data provided by Dr. Tate that from South Australia alone export of this pulse increased from 50 tonnes to 9500 tonnes in nearly three years (until May, 1992). I have no knowledge of the production figure on a global basis. Since this dramatic increase in the export of Vetch has taken place so recently, it is too early to assess its after effects on the populations of the importing countries.

Whether Vetch is consumed by animals or humans will be greatly dependent upon its availability and general scarcity of food for the given population. Desperate populations would eat whatever is available with the hope to survive without considering any toxic or long term effects. I acknowledge that nearly 90% of toxicity can be abolished by soaking the seeds overnight in water. However, soaking of pulses, particularly red lentils, is not generally practiced in major pulse using countries such as India. I have first hand experience in this regard. It is noteworthy that in these countries pulses constitute a large proportion of protein in human diet. The cooking practices in these countries are hard to change, particularly in the rural areas. Here I entirely disagree with paragraph 8 of the report prepared by Dr. R.B.H. Willis, Director, Academy of grain technology, Australia and paragraph 2 of the report by E. Boutrif, Senior officer, Food quality and standard service, U.K. (both these reports were attached with Dr. Tate's commentary).

It is also apparent that consumption of red lentils as food is not harmful to man but when Vetch splits were present

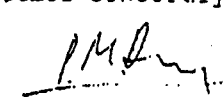
as contaminant, the preparation from such a mix would show toxic effects. Adulteration of foodstuff in the third world countries is not uncommon. In this respect we have not forgotten the scandal of adulterated edible oil in Europe which originated from Spain. We also remember the incidence when many lives were lost in Africa (Ethiopia or Sudan!) when pesticide-coated seeds meant for cultivation were directly used for preparing food by a large number of the population. Thus, exportation of split Vetch, for whatever purpose, which is difficult to identify when mixed with red lentils, would open up opportunities for adulteration and human consumption.

I therefore condemn exportation of untreated split Vetch for consumption whether designated for animals or humans. Detoxification of this legume seed should therefore be made compulsory prior to export.

Finally, I am strongly in the opinion that Dr. Tate's article should be given wide publicity. His commentary makes a lot of good sense. I would be very interested to know of your editorial decision. You may publish my letter as a support.

With best wishes.

Yours sincerely,


Dr. P.M. Dey
Reader in Plant Biochemistry

ATTENTION RURAL EDITORS

D3*.

"VETCH CLAIMS UNBALANCED"

Claims regarding the alleged deleterious effects to humans of consuming the grain legume blanchefleur vetch (*Vicia sativa*) are without proper scientific foundation, and are therefore unbalanced and irresponsible, according to Chairman of the Grains Council of Australia's Oilseeds & Grain Legumes Committee, Mr Allan McCallum.

(~~This was deleted from final release~~)

Blanchefleur vetch is a grain legume which produces an edible seed that competes with other legumes as a high source of protein suitable for human consumption.

Local scientists from the White Agricultural Research Institute in South Australia have, in an article about to be published in *Nature* magazine, drawn attention to the naturally occurring neurotoxins within blanchefleur vetch, questioned the effectiveness of cooking techniques in reducing the neurotoxin content of the raw legume, and warned of the possibility of substituting the "look alike" vetch for red lentils.

"What is quite remarkable about this situation", Mr McCallum claimed, "is that any question of blanchefleur vetch's suitability for human consumption is being raised by these scientists, and not by the consumers of the product."

"Are Australia's scientists to act as the social conscience for the international grain legumes market? If so, then unless they are to put at risk a rapidly growing grain export industry, then the scientific basis upon which they make their judgements needs to be far more complete than currently appears to be the case."

"The literature the scientists quote is very dated - in respect of toxicological studies, the most recent reference is 1969, whilst culinary processing studies date back to 1962."

"The simple extrapolation to humans of the results of toxicological studies on the effects of feeding untreated vetch to animals, will always be a matter of conjecture, unless supported by field evidence. Given that there continues to be a willing human consumption market for Australian-produced blanchefleur vetch, such an extrapolation is unsupported."

"The scientists appear to have discounted the benefits of cooking techniques in reducing the levels of naturally occurring neurotoxins, consumers' understanding of the importance of adequate preparation and cooking, and their capacity to differentiate between grain legumes on the basis of physical appearance, texture and taste."

"Notwithstanding, the Australian grain legumes industry has reacted quickly and responsibly to implement measures to properly identify blanchefleur vetch, and to address concerns about its suitability for human consumption."

1. Australian standards for receipt and export of vetch have been formulated and adopted by the industry.
2. Vetch for export is clearly labelled after phytosanitary testing by the Australian Quarantine & Inspection Service.
3. The Grains Council of Australia has agreed to the introduction of a compulsory research levy on the production of vetch. This will be matched by the Australian Government and administered by the Grains Research & Development Corporation.
4. The industry has commissioned research on the levels of neurotoxins in vetch. The research, undertaken by the Australian Academy of Grain Technology, measured the levels of neurotoxins present in blanchefleur vetch, and concluded that these levels are reduced by up to 90% through soaking or cooking.
5. The industry has commissioned further research at the Academy, under the direction of Academy Director Dr R B H White, on the rate of loss of toxins during soaking/cooking and the nature of breakdown products from the toxins.

"The results of additional research, commissioned by a responsible Australian grain legumes industry, will enable a balanced assessment of any possible risk factors associated with human consumption of blanchefleur vetch."

"The vetch industry in this country is a rapidly developing one, and one which provides valuable export revenue for Australia. It is unacceptable that the industry be put at risk by the alarmist and unbalanced suppositions of scientists of repute, however well-meaning they may be", Mr McCallum concluded.

Ends

Further information

Allan McCallum
Chairman

GCA Oilseeds & Grain Legumes Committee

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Mitch. Hoole
Executive Director

GCA

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CORRESPONDENCE

Coping with toxic pulses

SIR — In their recent Commentary article, Tate and Enneking¹ rightly draw attention to the potential hazard of supplying varieties of vetch seeds (*Vicia sativa*) for human consumption as a substitute for red lentils (*Lens culinaris*). Whereas the article focused on the presence in *Vicia* seeds of the toxic amino acid β -cyanoalanine and its γ -glutamyl derivative, there is an even more serious problem associated with the relatively high content of the pyrimidine glucoside vicine in these seeds.

Vicine has been recognized for years as the causative dietary factor in the disease favism, which is characterized by a potentially fatal haemolytic anaemia². Although it is now known to be present in most species of *Vicia*, it was from vetch seeds (*V. sativa*) that vicine was first isolated, a yield of 0.35 per cent being obtained^{3,4}. Favism occurs only in genetically predisposed individuals deficient in erythrocyte glucose-6-phosphate dehydrogenase and, although bouts can be induced by a variety of drugs, they most commonly follow ingestion of broad beans (*V. faba*). In the geographical areas where favism is prevalent, for example the Mediterranean countries, North Africa and the Middle East, sufferers quickly learn to avoid *Vicia* species. Passing off split seeds of *V. sativa* as red lentils in these areas would be particularly unfortunate.

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SIR — The consumers of the Middle East and India have thousands of years of experience in the preparation of foodstuffs, much of which, if consumed untreated, would be toxic¹. Consumers throughout the Middle East can certainly distinguish between lentils and vetch. The differences in shape (lens versus spherical), taste (vetch is favoured in some markets for its bean taste), texture and cooking time are natural inbuilt safety factors against substitution.

The latest Australian Bureau of Agricultural and Resource Economics (ABARE) production estimate of *Vicia sativa* for 1992-93 is 75,000 tonnes. It is expected that approximately 60 per cent of this production will be of the cultivar blanche fleur. The rapid expansion of the vetch industry in Australia has meant that the industry has needed to act quickly to address concern about description and quality. This has resulted in the following action by the industry in conjunction with various government departments.

(1) Australian standards for receipt

and export of vetch have been adopted by the industry.

(2) *V. sativa* for export is correctly labelled after phytosanitary testing by the Australian Quarantine Inspection Service, the Australian government body responsible for export inspection services. It has to be labelled as either vetch, blanche fleur vetch or red split vetch.

(3) The Grains Council of Australia (representing all grain growers) has agreed to the introduction of a compulsory research levy on the production of vetch. This will be matched by the Australian government and administered by the Grains Research & Development Corporation (GRDC).

(4) The industry has commissioned research on the levels of neurotoxin in vetch at the Australian Academy of Grain Technology, which ascertained the levels of neurotoxins, and concluded that these levels are reduced by up to 90 per cent through soaking.

(5) The industry has commissioned further research at the academy, under the direction of academy director Dr R. B. H. Wilks, on the rate of loss of toxins during soaking and cooking. The nature of breakdown products from the toxins will also be investigated.

The issue of the suitability of blanche fleur for human consumption has been clouded by statements and innuendo from various interest groups on consumption patterns, possible substitution for lentils and the extrapolation of historical data. The industry view is that the opportunity for substitution of vetch (*V. sativa*) for red lentils (*L. culinaris*) is minimal due to the Australian government requirements of appropriate labelling for export and the inherent characteristics of vetch. Differences in taste, texture and cooking time make the two readily discernible to consumers.

The Australian grain legume industry has not been able to identify any published example of human poisoning by *V. sativa*. While we accept there are problems in certain sectors of the livestock industry when excessive amounts of *V. sativa* are included in rations, to extrapolate these findings to humans would endanger the credibility of the proponents of such action.

Allan D. McCallum
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Test-ban treaty

SIR — Your leading article (*Nature* 359 465; 1992) correctly points out that the conclusion of a comprehensive test-ban treaty would improve the prospect (already quite good) for a successful outcome of the 1995 conference that will decide how long the Nuclear Non-Proliferation Treaty (NPT) will be extended. You make much of the point that France and China should join. In fact China acceded to the NPT in March this year and France followed suit some four months later.

You suggest that a comprehensive test-ban might be brought about by amending the NPT. As a former member of the staff of the IAEA (International Atomic Energy Agency), I should like to point out that it would be far simpler to conclude a separate treaty, replacing the existing partial test-ban treaty of 1963 (which France and China have not joined). Amending the NPT is almost impossible. Every party to the NPT that also happens to be a member of the governing body of the IAEA (there are usually about 28 NPT states on the IAEA governing body, from all parts of the world) can block an amendment by voting against it and again later by failing or forgetting to ratify an approved amendment. No other international arms control treaty places such a formidable barrier in the way of its amendment and, unsurprisingly, none have been attempted.

David Fischer
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Thinking physics

SIR — I endorse Sacks' description¹ of Edelman's theory of consciousness as having "great force and originality". Nevertheless, it is not a fully general or "transparent" theory in the sense alluded to by Gray². Edelman³ is concerned primarily with the evolution and neurology of human consciousness. This perspective cannot lead to general predictions about the existence of consciousness in other creatures or in artefacts, as Edelman concedes. The fundamental problem remains: to characterize those physical structures that are necessary and sufficient for the presence of consciousness wherever it might be found. What physics will be required to answer this question remains to be seen.

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Dr. Max E. Tate
Dr. Dirk Enneking
Department of Plant Science
Waite Agricultural Research Institute,
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Australia 5064

Dec. 3, 1992

Dear Dr. Tate and Dr. Enneking;

I was fascinated to read your recent article in Nature ("A mess of red pottage" 359:357-358) about the differences between 'blanche fleur' Vicia sativa lentil mimic and traditional red lentils. It seems we are facing a similar problem here. I have decided to write to both of you in the chances that I would reach at least one of you in station.

We have also had some recent enquiries about pulses sold as red lentils, but paler in appearance, and which exhibit difficulties in cooking (These were reportedly not grown in Australia). Apparently a good quantity of these 'lentils' have been traded on the international markets; we think we have also found them in Minneapolis markets (our enquiry was from elsewhere). These are reported to require up to 2 hours for cooking, whereas normal lentils require less than 15 minutes; therefore there is a problem in acceptability.

We have been asked to help to determine whether or not the 'lentils' in question are really lentils or something else. We have salvaged some whole seed and are growing them out and comparing plant morphology with traditional lentil varieties (they are significantly more viney). Would you be willing to send us a small quantity of 'blanche fleur' vetch seed so that we make a comparison?

Your report of neurotoxins raised our interest in this issue beyond marketability to one of food safety. We would also like to examine the proteins of our unknowns via electrophoresis. Would you be willing to send your methods for your qualitative paper-electrophoretic analysis, as well as a B-cyanoalanine standard (or sources to obtain the standard)? I assume that this is toxin of greatest concern.

If it is possible to send the above by courier, that would enable us to complete this analysis in a timely way. We would be happy to reimburse you the costs of this (please enclose invoice). Any additional publications you have on this issue would also be of

great help to differentiate between these species.

Thank you for your very informative article which seemed to speak directly to our situation. We will try and keep you informed as to our results.

Best Regards,

Daniel H. Putnam

Daniel H. Putnam,
Asst. Professor
Project Leader, New & Alternative Crops.

cc. Bruce Johnson
Lee Hardman
Dave Somers



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March 15, 1993

Professor Max E. TATE
Department of Plant Science
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Dear Professor TATE,

Few things in life are as pleasurable as appreciation by one's colleagues. I thank you for that. I treasure your fine article in Nature of October, 1992 and your recent kind personal communication and will reread them whenever morale is in need.

Naturally, I was astounded by the commercial development of common vetch as a food. In the past few weeks I have been trying to make my own assessment of risk, and I have come to the same conclusion as you, that without special treatment common vetch seed is unsuitable as a food. We should all be indebted to you for recognizing the risk and stopping this business in time. Let's hope your efforts towards detoxification will make the vetch acceptable as food.

I hope to have the pleasure of meeting you some day. Thank you again.

Yours sincerely,

Charlotte Ressler

Charlotte Ressler, Ph.D.
Professor of Pharmacology

Health and economic implications of imported toxic legumes

Ramesh V. Bhat and T. C. Raghuram

The importance of legumes in human nutrition has been well recognized. They play an important role in Indian dietaries, specially in view of higher cost and scarcity of animal proteins as well as the vegetarian way of life. With the success of green revolution, there has been a significant increase in the production of cereals such as wheat and rice. Similarly, thanks to the efforts of the Oil Technology Mission, there has been a spurt in oil seed production. However, the production of legumes has remained almost static over the years. To meet the domestic needs, pulses have been imported from several countries. In contrast to cereals and oilseeds, some of these legumes do contain naturally occurring toxic substances such as unusual amino acids¹.

Outbreaks of diseases such as Lathyrism due to consumption of *Lathyrus sativus* as a staple food, specially during drought conditions, have been well documented². Even consumption of smaller quantities of *L. sativus* for prolonged periods is suspected to result in spasticity³. The other members of the subfamily of *Lathyrus* namely *Vicia* and *Lens* are also known to contain toxic principles. In India, the pulse *Vicia sativa* was considered a forage legume, and a weed growing along *L. sativus*. It is reported to be poisonous to cattle, pigs, poultry and even to primates, causing symptoms like lupinosis. However, it is used for feeding cattle after detoxification⁴.

During the last two years, Australian farmers have been cultivating 'blanche fleur' cultivar of *V. sativa* on a large scale as a food export cash crop. In 1992 alone, about 10,000 tonnes of this pulse was exported as split red vetch. Recently, Tate and Enneking⁵ have warned the consumers and scientific community of the possibility of red vetch, exported to the Middle East under different names such as 'split blanche fleur/red legumes/red dhal/split red lentils', being used for human consumption. They have also considered the likely reexport from the Middle East to Indian subcontinent. Many varieties of vetch contain toxic

amino acids such as beta cyanoalanine and its gamma glutamyl derivative, making them unsuitable for human consumption⁶. In addition, they are also reported to contain relatively higher quantities of the pyrimidine glucoside vicine⁷ which is known to cause favism—a disease in humans characterized by fatal haemolytic anaemia. In spite of these serious health implications, the Australian Grain Legume Committee has defended the export of toxic pulse under the pretext that although there are problems in certain sectors of the livestock industry when excessive amounts of *V. sativa* are included in rations, to extrapolate these findings to humans would endanger the credibility of the proponents of such action⁸. Since most of the toxicological evaluation studies in relation to food safety are based on animal experimentation, such an argument is totally unscientific and questions the very validity of the use of animal experimentation in biomedical research. In addition, even to consider such a contention, it will be of interest to know whether the National Food regulation authorities of that country, where such toxic pulses are cultivated and exported, would permit its consumption by its population.

The blatant and selfish violation of the scientific principles by the trade, disregarding human health implications among the consumers of such toxic pulse, raises important ethical considerations for food export/import. It is in this context that we had earlier called for appropriate guidelines to safeguard human health by the Codex Alimentarius Commission of the FAO/WHO as well as countries exporting, importing or cultivating legumes reported to contain toxic constituents⁹.

Even as these issues are being debated in academic circles, some Indian traders have gone a step further and imported these 'vetches' as Australian lentils from Australia with tax concessions under the 'export promotion scheme'. Recently, it is alleged that 450 metric tonnes of vetches have been seized in Maharashtra by the Department of Revenue Intelligence for misuse of

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'export promotion scheme'. The Food and Drug Administration in Maharashtra is seized of the issue and the adulteration of Indian lentils (masur dhal) with imported *V. sativa* is being investigated by the Directorate of Central Food Laboratories, Pune.

The import of toxic *V. sativa* from Australia under various names, misleading the Indian customs and health authorities, poses a serious health hazard to the Indian consumers. In addition, such gross adulteration has enormous economic implications. However, such episodes are not new. A few years ago, even yellow lentils were imported from Turkey by the Indian traders and passed on to the consumer as pigeon pea (tuar dhal). It is in this context that the Government of India has recently, taken the right decision to ban the import of *V. sativa* in order to safeguard the interests of Indian consumers. In the light of these recurring episodes, greater vigilance need to be exercised by the Food control authorities of the Government, import/export regulating authorities and consumers. Meanwhile, the wholesale and retail trade as well as the importers have to evolve a code of conduct for self-regulation. Only a combination of such concerted efforts combined with education of the consumers would safeguard the interests of the nation.

In India, there are several food regulations such as Prevention of Food Adulteration (PFA) act, Agricultural Produce (Grading and Marketing) act, Fruit Produce order, Export (Quality Control and Inspection) act, Meat Products order, Vegetable Oil Products order, and ISI (Certification Mark) act. These regulations are supervised and implemented by several agencies of Central and State Governments spread over in the Ministries of Health, Food, and Commerce, and there is hardly any coordination among various agencies in this regard. In order to improve the functioning of the existing set up and to

integrate the activities of various agencies involved in food safety regulation, there is an imperative need to set up an apex body at the national level. Although such a recommendation has been made earlier¹⁰, the recent incidents, circumventing the existing regulations, reinforce the immediate need for such body.

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The authors are in Food and Drug Toxicology Research Centre, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad 500 007, India



Mick Gayler, WA Co-op Bulk Handling with WA Farmers Federation grains section president, Laurie Marshall at the National Grains Conference in Adelaide.

Vetch ruled as unsuitable

THE GRAINS Council of Australia has finally come to terms with the Blanchefleur vetch controversy and admitted the issue of toxicity remains unresolved and that the vetch is unfit for human consumption.

The GCA's Oilseeds and Grain Legumes Committee's decision during Grains Week effectively concludes debate on the suitability of vetch for human consumption which began just on 12 months ago.

Controversy over vetch began with world wide publicity over the possible toxic nature of Blanchefleur vetch.

The situation was exacerbated by the shipment of vetch labelled as lentils.

The uncertainty of the market was even further compounded in January this year when India banned all imports of Blanchefleur vetch followed by Egypt in February.

A meeting of the Grains Research and Development Corporation in March to, among other things, define the toxic status of the vetch for human consumption failed to reach a verdict leaving the industry to reluctantly acknowledge that it was indeed not fit for human consumption.

South Australian delegate Trevor Day said the future for the 20,000-



Chairman of the WA coarse grains council, Gavin Drew, with John Lovett, Grains Research and Development Corporation, Armidale, NSW at the Nationals Grains Conference.

plus tonnes grown in SA last season now lay with detoxification processes currently being developed but at least 12 months away.

Mr Day told the committee meeting there was a push by farmers to sell existing stocks with prices around \$350 a tonne having been paid in the past still fresh in their minds.

Mr Day also defended Dr Max Tate from the Waite Campus of the University of Adelaide who has been widely criticised for his published comments on the toxicity of Blanchefleur vetch.

"We must look as why he made his comments in the first place," Mr Day said.

"Where would he have been as a scientist if he had remained silent and there had been 100,000 deaths," Mr Day said.



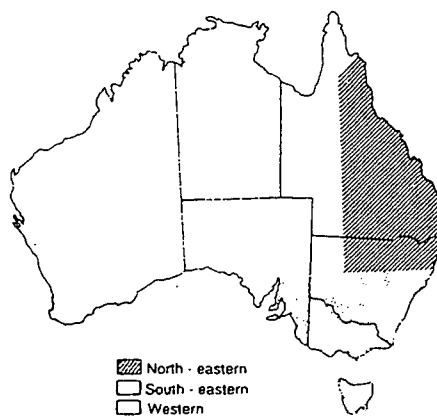
Nicki Kenyon, Grains Council, Canberra with general manager of WA Co-op Bulk Handling, Ray Deminico at the National Grains Conference in Adelaide.



Pat Staal, from central Queensland with Rachel Poots, Grains Council communication officer, Adelaide, at the National Grains conference.

GRDC splits research into efficiency zones

GRDC Research Regions



THE GRAINS RESEARCH Corporation has divided research zones in a new structure with more direct committees will come.

The change from one committee will come resulting in one zone in WA, the grain growing in Tasmania and NSW from the third from Dubbo northwards.

An original proposal which Eyre Peninsula included in the GRDC was abandoned by the GRDC.

However, the changes presented to the Grains Council during Grains Week, particularly which wanted the existing structure despite the fact that state parties to gain from the restructuring.

NSW delegate Ian Dinges pointed out that his state would be winners under the GRDC plan with representatives in two regions and a majority on the national administration structure.

However, NSW delegates continued to push for a state-by-state regional structure and was also critical of what they saw as the GRDC forcing the system on them without any consultation.

He said rail delivery systems, the Wheat Board and tertiary research, all organised on a state basis and then research administration should also be on a state basis.

However, a motion to oppose the proposal was defeated in favor of a motion supporting the proposal but calling for consideration of among other things 50% membership of the controlling regional panels.

GRDC chairman Don Blesing said the plan to streamline the organisation would give growers a far bigger say in the research effort.

Each of the three new panels would, he said, be responsive to the needs of growers and the industry within each region.

The regions will be headed by Merriken grower and industry figure Mick McGinniss in the Western region, the professor of sustainable agriculture at Adelaide University Tim Reeves in the South Eastern region and Australian Wheat Board member Norm Marran from NSW.

Mr Blesing said the regions had been determined by markets and climate rather than on state borders.

"The three regions are predicated by the industry's two natural divides: north-south between summer and winter crops and east-west by the Nullarbor," Mr Blesing said.

He said emerging issues such as the \$10 million snail plague and next season's rust threat in the South East region could not be met just by intra-state research but required inter-state research and development co-ordination, management and grower action.

However NSW's Tom Hammond said he was annoyed that the proposal had been presented to the GCA as a fait accompli.

He believed the GRDC had completely disregarded the GCA and farmer organisation in developing its proposal which resulted in a lack of grower confidence in the GRDC.

However, Mr Blesing said that over the past six months the GRDC had consulted with the GCA but still reserved its legislated right to put in place the best structure.

Mr Blesing said while he recognised that NSW may be disappointed at being split under the new arrangements he did not believe it was significant.

"The same research will go on but it will now be better focussed," Mr Blesing said.

New legume leader to woo Grains Pool

THE NEW president of the Grains Council's Oilseed and Grain Legume Committee, Trevor Day, vows to win the support of the Western Australian Grains Pool.

In the only significant controversy from at last week's Grains Week, South Australia's Mr Day, from Riverport, replaced Allan McCallum, who after five years at the helm conceded that he "didn't have the numbers to win again".

At the centre of the election was the Grains Council's push for an Australian Grain Legume Corporation, a body which would oversee the development and promotion of Australia's fledgling legume industry.

Mr McCallum has been a driving force behind the corporation proposals but has been frustrated by the opposition from the WA Grains Pool, which, because of its strength in lupin exports, accounts for more than half of the nation's grain legume exports.

The Grains Pool has long feared that a corporation could threaten its reign over market promotion and grain standards.

When the five-delegate committee voted on the proposal for incorporating a corporation, the WA delegate, Don Stevens with support from Queensland's Peter Staal and Trevor Day, defeated the motion, and adopted a watered down version. (Although, two hours later when the all embracing National Grain Legumes Consultative Committee voted on the proposal, Mr Day switched his vote in favor.)

Quite clearly, the Grains Pool which was represented at the meetings with several observers



Trevor Day: needs to win over the WA Grains Pool to new national legume body.

had organised the demise of Mr McCallum's presidency.

At close of last week's meetings, many delegates were unsure whether a legume corporation or an association as the delegates now preferred to call it would be formed particularly as the Oilseed and Grain Legume Committee had voted against it.

Mr Day in the meantime saw his challenge as winning the support of the Grains Pool for the proposed Australian Grain Legume Association.

In other election results, South Australia's Allan Glover was elected unopposed as chairman of the Coarse Grains Committee, NSW's Ian Dinges to lead the Wheat Committee, and South Australia's Brendon Smart to lead the Seeds Committee.

The only change to the Grains Council executive committee, was that West Australian, Laurie Marshall, replaced John Walsh, who failed to win renomination from his state affiliate, the West Australian Farmers Federation.

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APPENDIX E

Extracts* & References:

E1*. Victorian "Weekly Times" Article (March 31 1993), Scientists cripple vetch industry.

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GRAINS CONFERENCE

E1*

Scientists cripple vetch industry

Reports: BOYD
CHAMPNESS and
DEBBIE ANDREW

GRAIN growers have moved to muffle the freedom of scientists funded by the grains industry, after the destruction of a fledgling \$18 million legume industry.

They want industry funding withdrawn from any scientist who does not consult with grain growers, exporters and marketers before issuing potentially damaging information and media statements.

The move follows the downfall of the key export markets India and Egypt for the blossoming red vetch *Vicia sativa*.

Grain growers have set about the long haul of regaining the markets which they claim were ruined by unfavorable publicity.

Toxic

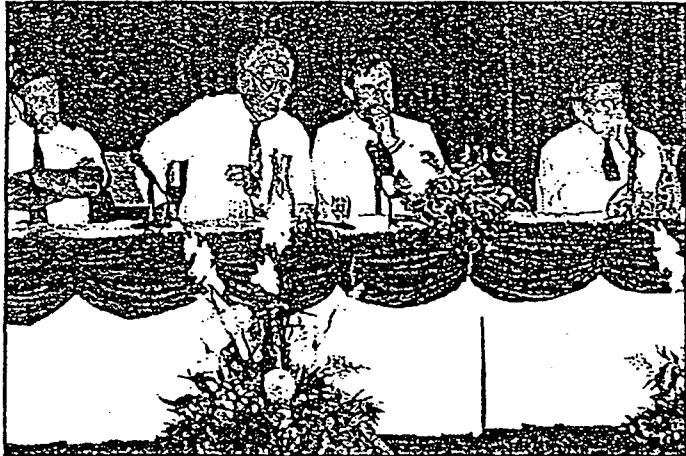
The vetch industry hit the Australian news headlines last year after Waite Institute of Agricultural Research scientist Dr Max Tate and a Ph.D. student Dirk Enkeling wrote to world science magazines warning that the legume was potentially toxic to the human nervous system.

This prompted India to ban the import of "toxic pulses" from Australia.

The Egyptian Government this month also invoked a ban following an alleged substitution of lentils for vetch in an Australian export order.

The future of the industry and costly research into proving the scientific claims wrong were being thrashed out at a closed meeting late yesterday.

The meeting included representatives from peak farming groups, exporter companies, toxicologists, cereal researchers and



Victoria's grain hierarchy . . . Peter Bufton, David Thomas, Allan McCallum and Peter Cook.

nutritionists. Their recommendations will be followed up at Grains Week in April.

Growers at last week's annual Victorian Farmers Federation Grains Group conference were furious about what they claimed was a "scare campaign" waged by the Adelaide scientists.

Swan Hill vetch grower Geoff Nalder said it was outrageous that a publicly-funded individual could embark on a private crusade in the international media before "scientific evaluation had been completed and prior to any consultation with the grains industry groups".

Victorian Farmers Federation grains group director Peter Cook said the incident was a tragedy because vetch had proved an ideal legume as a rotation crop with cereals in the Mallee and Wimmera.

Delegates at the meeting also called on Primary Industries and Energy Minister Simon Crean to urgently tackle the Indian, Sri Lankan and Pakistan governments over bans on *Blanche fleur* vetch.

The federation's grains group president Allan McCallum warned growers they faced a massive task to turn around the Indian and Egyptian bureaucracies.

He said the catastrophe had highlighted the lack of information about vetch.

"We have not been able to find evidence anywhere in the world where neurotoxins (present in vetch) are harmful to humans.

Test

"Latest test results have found that the pH levels in water had a significant effect in breaking down neurotoxins, and that pH level roughly coincides with the pH of the human stomach.

"This opens up a possible range of research that may give the answer to why there's no records of harmful effects on humans."

Mr McCallum said GRDC and exporter funding for tests at the Academy of Grain Technology had dried up.

Research to restore credibility to the industry

would be extremely taxing on resources and growers at some stage would have to look at whether it was feasible to continue.

"The task of turning these governments around is going to require very good research with very good results.

"What we're basically doing in Australia is building up information on vetch because it seems there's very little research around the world.

"Now that task may be too big for Australia," Mr McCallum said.

He said the consequences of the market losses were much broader than the human consumption market.

It has also left Australian, Chinese and Turkish vetch hanging over the fodder vetch market and will pressure prices.

The loss of the vetch export trade has been particularly heartbreaking for Mallee farmers who had finally found a legume ideal in crop rotations, with good returns and flexibility to graze, green manure or harvest.

Vetch stubble also prevents the Mallee sands from drifting.

Original Articles

A NOTE ON SOME CASES OF LATHYRISM IN A PUNJAB VILLAGE

By S. R. A. SHAH, X.S., M.B., B.S. (Punjab),
D.T.M. (L'pool), D.P.H. (Lond.)

District Medical Officer of Health, Sialkot

Introduction

IN October 1935, I received information that in the village of Nawan Kulla in Narowal tehsil the inhabitants had been stricken with a mysterious malady which had crippled them. The villagers attributed this to the curse of certain Sadhus who had been abused and turned away from the village by them. Suspicious of an outbreak of an unusual disease like infantile paralysis or scurvy, I left for the village. Soon after my arrival I was surrounded by a crowd of villagers many of whom had walked up to me with difficulty with a waddling gait and supported by long sticks. This type of disease is not known to have occurred in this part of the province before.

Circumstances of village Nawan Kulla

The village is situated some eight miles to the south-west of Narowal town and about two miles from Raya station on the North Western Railway. The Punjabi word *nawan* means new. It is so called because the village is of recent origin, about 15 years old, and is really an off-shoot of the older and bigger village Kulla from which it is separated by about a mile. Originally it was just a well with one or two huts close by. Certain poor families from Kulla gradually migrated to this place and thus a small village sprang up.

Nawan Kulla is situated in a low-lying area. Drainage of the high ground to the north and east of the village runs along the southern boundary of the village to join the Ravi river which is four miles from it. When the monsoon rains have been heavy the village gets surrounded by water on three sides.

The population of the village is 205, out of which 104 are Sikhs, 71 Muslims, 21 Christians and 9 Hindus. The 9 Hindus belong to one family of 'Kahars' who are engaged as water carriers. Out of the 9 families of Muslims, 5 are weavers, 3 carpenters and one potters.

The Sikhs are agriculturists. Their holdings are very small and they are extremely poor. The land is irrigated from wells, and where these do not exist they depend on rainfall for their cultivation. The soil is poor in quality. The chief 'Kharif' crops are rice and maize and 'Rabi' crops are wheat and a certain amount of pulses. A small amount of ghee and a little superfluous grain are exported and these constitute the only outside source of income. The Muslims are somewhat better off economically,

but the poverty of the village as a whole can be well judged from the fact that there is not a single *bania's* shop in the village.

As regards diet, the Muslims eat well and an occasional plate of meat or eggs provides some variety in the routine diet of wheat *roti* with *dāl*, whey or *sag*. The Christians also, on account of the nature of their avocation (labour), get some change in their food as they move from place to place in search of work. The Sikhs, being poor and more or less stationary in the village, sustain themselves on the monotonous diet of wheat *roti* taken with *dāl*, *sag*, boiled turnips or pickle. Rice is taken occasionally.

Clinical manifestations of the disease.

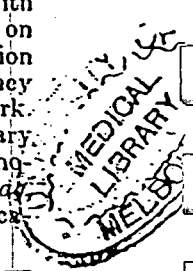
Enquiry elicited that the disease had made its appearance in the month of June and since then had steadily increased. At the time of enquiry 64 persons out of a population of 205 were seen in the various stages of the disease.

Onset.—In 34 cases premonitory symptoms such as attacks of nausea or vomiting after meals and diarrhoea manifested themselves for 5 to 14 days before the characteristic symptoms of the disease appeared. Two of these cases also gave a history of attacks of intermittent fever with rigors and sweating lasting for 5 or 6 days. In the remaining 30 cases the disease was reported to have come on suddenly, and often during the night. Persons who had gone to bed quite well awoke next morning feeling stiff in the legs.

A marked feature in a number of cases was the sensory symptoms in the affected limbs, which preceded or accompanied the paralytic symptoms. A tingling sensation appeared in the soles of the feet which soon spread to the legs. Analgesia, anæsthesia and formication were also present. Both legs were affected simultaneously.

Thus, it will be seen that the earliest symptoms varied from gastro-intestinal disturbances to sensory symptoms in the legs or spasticity of the legs.

General symptoms.—Within 10 days to a month of the onset, signs and symptoms of a spastic diplegia supervened. The influence of muscular tension was apparent in the gait of the patients. Early and slight cases were able to walk for a fairly long time but the movements of the legs were slow and laboured. The knees got slightly bent owing to over-action of the flexors and more weight was thrown on the toes than on the heels. For a month or so the spastic symptoms predominated over the paretic, the spastic gait then gradually changed to spastic-paretic, and a decrease in muscular power was complained of in addition to the stiffness. Paresis of the leg muscles varied from simple impairment of movement to more or less complete paralysis of the muscles of the legs. The flexor muscles were involved first as a rule. The patient could not, or only with difficulty, dorsiflex the foot. The muscles of the affected limbs



were hypertonic. Any attempt at movement, active or passive, gave rise to muscular contraction which sometimes was painful.

The superficial reflexes, epigastric and abdominal, were exaggerated in the early cases but were feeble or altogether absent in the old cases. The plantar reflex, so difficult to elicit in the horny soles of the villagers, was extensor in type in those in whom it could be elicited (Babinski's sign). Knee jerks were also exaggerated in all early cases, but tended to get sluggish as the disease advanced. Ankle clonus was elicited in 14 cases. The sphincters of the rectum and bladder were unaffected. There was no impairment of the functions of the cranial nerves and speech, sight and hearing were normal. There were no mental symptoms or psychic disturbances. Sexual potency was diminished in some but never lost. Bed sores were not seen.

The respiratory and circulatory systems showed no involvement. Urine analysis and microscopic examination of blood revealed nothing of interest. Wassermann reaction in the case of three patients who were sent to Mayo Hospital, Lahore, proved negative.

Notes on some cases

The following are brief notes on some cases:—

Case I.—(Fig. 1.) A Sikh female, aged 19 years. She was one of the earliest who developed the disease and was a bad case. The disease started with an acute tingling sensation in the soles of the feet which soon spread to the legs. Walking was troublesome on account of hyperesthesia and analgesia of the soles of the feet. In a few days spastic symptoms developed in the legs which made walking still more difficult. Adduction of the thighs and flexion of the legs became so firm that any passive or active effort at straightening or separating the legs was accompanied by extreme pain. Weakness of the legs also appeared and gradually increased. At this stage tingling sensation appeared in the palms of hands also, but it was not as marked as that of the soles of the feet. Spasticity and paresis of the forearms also developed but to a much lesser extent than in the legs. Hyperkeratosis of the soles of the feet became evident a couple of months after the onset. Some hyperkeratosis of the palms of the hands was also evident later on.



Fig. 1.

Present condition.—Her gait is still spastic but she is able to do all her household work. The knee jerks are slightly exaggerated. There is no permanent shortening of any muscles.

Case II.—(Fig. 2.) A Sikh, aged 30 years. He was one of the earliest cases, and his condition was definitely the worst. The disease was ushered in by dyspepsia and vomiting on taking wheat *chapatis*. This was followed by the usual symptoms of the disease. The special feature was the acute involvement of upper extremities which gave rise to wrist drop and the 'main en griffe' which is well illustrated in the photograph.

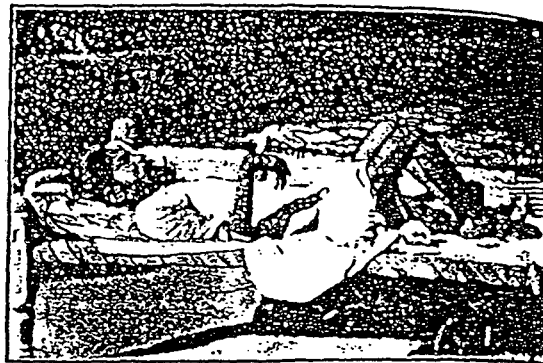


Fig. 2.

Present condition.—The spasticity and weakness of the muscles is still considerable. He can manage to walk with the help of a stick, but with laboured steps. In spite of serious and prolonged illness there are hardly any trophic changes.

Sex distribution.—Out of 115 males and 90 females residing in the village, there were 38 males and 26 females affected with lathyrism, i.e., about 33 per cent of the male population and 28 per cent of the female population suffered.

Age distribution.—Out of the 64 cases that occurred, the following was the incidence rate per 100 by decennial age groups.

Age group	Population	Number of cases	Percentage affected
1-10 years	36	9	25
11-20 "	61	18	30
21-30 "	59	21	41
31-40 "	37	9	24
41-50 "	13	4	30

Racial distribution

Community	Population	NUMBER OF PERSONS AFFECTED		
		Total	Males	Females
Sikhs	104	59	35	24
Muslims	71	5	3	2
Christians	21	..	..	..
Hindus	9	..	..	..
TOTAL	205	64	38	26

It will be seen from the above table that the members of the Sikh community were the principal sufferers. Fifty-nine cases out of 64

occurred amongst them, and all advanced cases were Sikhs. The 5 cases that occurred amongst the Muslims were of a mild type.

Seasonal occurrence.—The distribution of cases according to the month of onset is given below :—

June	..	..	..	8
July	..	..	..	16
August	..	..	..	21
September	..	..	..	14
October	..	..	..	5

The disease started in June, was in full swing in July, August and September, and in October its progress was arrested with the institution of preventive and curative measures detailed elsewhere.

Diagnosis

The mode of onset and course of the disease, spastic paraplegia, characteristic gait, and improvement of cases on giving up the use of suspected articles of diet, led one to the conclusion that the disease was lathyrism. This diagnosis was later confirmed by Dr. A. B. Arora, Assistant Director of Public Health, Lahore.

Differential diagnosis

Beri-beri.—The disease resembles beri-beri (dry form) in certain respects and is likely to be mistaken for it. In fact, the multiple peripheral neuritis and the dyspeptic symptoms seen in some cases suggested beri-beri in the first instance, but on closer examination of ætiological factors and clinical manifestations important differences were noticed. Namely, the patients did not live chiefly on rice and did not use white wheaten flour, the muscles were not found wasted and flabby, and the typical cardiac symptoms were absent.

Ergotism (spasmodic type) is differentiated by the facts that rye is not used at all in this area, and vertigo, headache and epileptiform convulsions were absent. To make certain that cereals other than rye had not been attacked by the fungus *Claviceps purpurea* the flours derived from wheat and rice were tested for ergot by the simple test advocated by Bottger; i.e. the sample is mixed with ether and a few crystals of oxalic acid added. It is then brought to the boil and allowed to become clear by standing. If the clear supernatant fluid shows a red tinge ergot is present.

Pellagra.—The characteristic skin eruption, sore mouth and the psychic disturbances in pellagra were absent.

Ætiology

The elucidation of the causal factor presented a certain amount of difficulty. *Lathyrus sativus*

(*matlar* or *khasari*), which is most commonly associated with the disease, is not grown or used in this area. The cereals grown and used by the villagers are :—wheat, maize, gram, urad, mung and rice.

Maize, urad, mung and rice are eaten sparingly and very small quantities of these were recovered from the houses. On my first visit to the village, the villagers were advised to give up the use of all old stocks of food grains and obtain fresh supplies from a distant village. They got rid of the old stocks by feeding cattle on them or giving them to me for purposes of examination, with the exception of wheat, of which they had considerable quantities and were loath to part with and I did not press them at that time because I did not suspect wheat to be the cause of the mischief. Samples of wheat, however, along with those of other cereals were sent to the public health chemist for examination in collaboration with the Professor of Botany of the Government College, Lahore. In the meantime I was struck with a general complaint of the patients that whenever they ate wheat *chappatis* there was a set-back in their progress. The spasticity of the legs increased and they felt worse next morning. At first I took this to be just an accident but later when they persisted in their complaint I instituted a detailed enquiry. It was elicited that this complaint came only from those who had old stocks of wheat, while those who were not using wheat, or had obtained fresh stocks of wheat, did not suffer from such exacerbations of the symptoms. It was discovered that some of the villagers had not actually disposed of their old stocks of *dāl* and rice, and were still making use of them. These also said that when they partook of *dāl* and rice they did them no harm, but when *chappatis* made from old wheat were taken it made them feel worse. This focussed my attention on the wheat. The old stocks of wheat were found to be contaminated with seeds of *Vicia sativa* (*akta*) to a considerable extent. A handful of wheat when placed on a dish showed eight or ten seeds of *akta* at a glance. The report of the public health chemist confirmed this, and he reported that wheat flour was contaminated with *akta* as well. As a further test that the seeds contaminating the wheat were of *Vicia sativa* and nothing else, the seeds were sown and grown up plants compared with the dried specimen of *Vicia sativa* plant kindly given to me by the Professor of Botany, Government College, Lahore. The use of old wheat was discontinued and the complaint of set-backs ceased with it.

In view of the observations made and explained above I am of the opinion that seeds of *Vicia sativa* contaminating the wheat were the root cause of lathyrism in this outbreak. The fact that the incidence of the disease coincided with harvesting the wheat crop lends support to this view.

Treatment

Proper dietetic and medicinal treatment could not be carried out on account of the extreme poverty of the sufferers whose meagre resources had been further depleted by the long illness of the earning members, and also by their payments to quacks, *hakims* and *voids* in the hope of getting cured during the four months prior to my visit. At my request the Sialkot District Board very considerably sanctioned Rs. 200 for the treatment of the cases. Another Rs. 20 were collected by contribution. This enabled me to provide rations of milk, eggs and vegetables for the cases (one family had to be given even wheat to save the members from starvation), and also to institute medicinal treatment. Mild cases were put on iron-arsenic mixture while advanced cases were given an iodide mixture. A digestive tonic mixture was also given when symptoms demanded it. With alteration in diet, the disease was arrested but the improvement of cases was very slow. Medicinal treatment failed to produce any marked effect. After a month's trial of this routine, intensive vitamin treatment was added to it. Half the cases were put on Adexolin and the other half on halibut oil. Under the vitamin treatment there was a marked acceleration in the rate of progress of the cases. Full doses of halibut oil and Adexolin were administered regularly. On account of the high cost of these preparations their administration had to be restricted to bad cases only, and when improvement reached a certain stage these had to be stopped. Under this treatment the aching of spastic muscles and tingling sensation in the feet, when present, were the first to disappear. The spasticity diminished and the muscles gradually acquired strength. The treatment was kept up for six months. At the end of that period more than half the cases had returned to their respective avocations while the remainder had progressed remarkably. Only a few milder cases, however, could be considered cured completely as quite a number still complained of stiffness of the legs.

Discussion

Some uncommon features were observed in this outbreak which are worth mentioning.

McCombie Young (1927) found malarial fever a common antecedent of lathyrism. The village Nawan Kulla is not situated in a malarious tract, no one was found to possess a palpable spleen and only 2 cases out of 64 gave history of intermittent fever preceding the attack.

Sensory disturbances which formed quite a marked feature of this outbreak have generally not been noticed. Marked anaesthesia and analgesia are described by Proust (Stockman, 1917), but not by other authors.

The sphincters are usually described as affected but they were not affected at all in this series of cases. Sexual potency, which is often

(Continued at foot of next column)

THE USE OF BLOOD TESTS IN EXCLUDING PATERNITY AND MATERNITY

By S. D. S. GREVAL

LIEUTENANT-COLONEL, I.M.S.

Imperial Serologist and Chemical Examiner to the Government of India

Imperial Serologist's Laboratory, The School of Tropical Medicine, Calcutta

I. Definitions and explanations of terms

By the term 'blood test' in connection with excluding paternity or maternity is meant the determination of the blood groups and the blood types of the subjects concerned.

The blood groups are four: O, A, B and AB. The types within each group are: M, N and MN. The accompanying diagram explains these and

(Continued from previous column)

reported as lost (Stockman, 1917), was reduced but never altogether lost.

The legs only are usually reported to be affected (Sleeman, 1844). In this outbreak the arms were involved in a number of cases.

Sex incidence is generally reported by authors as 5 to 10 times greater in the males than in the females. In this outbreak it was 3 males to 2 females who suffered.

Lathyrism being absolutely unknown before in this part of the country it is rather difficult to arrive at much aetiological and epidemiological data from observations made in one outbreak. Taking everything into consideration it seems probable that this outbreak was due to the presence of seeds of *Vicia sativa* in wheat. It thus lends support to the *akta* contamination theory first advanced by Anderson *et al.* (1925). The legume *Lathyrus sativus* is neither grown nor used in this area to any extent and is, therefore, out of the question.

Avitaminosis seems to play some part in the production of symptoms. In support of this it may be stated that many symptoms resemble beri-beri and pellagra, two known 'deficiency' diseases, and that the cases improved remarkably under dietetic and vitamin treatment.

Judging from the symptoms it seems probable that the pyramidal tracts of the spinal cord are chiefly involved, although variations in symptoms suggest that more than one tract is affected. It is also probable that the peripheral nerves, both motor and sensory, are involved.

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which was a grant towards the work of the Najafgarh Rural Unit.

The majority of civil welfare centres aided by Indian Red Cross funds received their grants direct from the provincial branches of the Indian Red Cross Society.

The Victoria Memorial Scholarships Fund was distributed almost wholly as grants-in-aid for *dai* training. Grants were given to seven *dai* training schools. Other aided schemes give institutional and domiciliary training, or are entirely domiciliary, the training being carried on in connection with welfare centres. Some of the *daïs* on completion of training and after passing an examination receive V.M.S. certificates of which 139 were issued during the year, while others are given the trained-*dai* certificates of the province or state *dai* school.

The Army Child Welfare Fund was distributed to 54 Indian and 26 British Army centres during the year 1938. Army child welfare work owes much to the help and enthusiasm of voluntary workers and the progress in this field is marked. But the lack of training in preventive work of sub-assistant surgeons and nurses appointed to Army child welfare centres, is in many cases a handicap to constructive work, and facilities for such training for sub-assistant surgeons and the replacing of nurses and midwives by trained health visitors is much to be desired.

The Junior Red Cross activities for the promotion of health increased in all directions, specially in anti-epidemic and village improvement work.

At the request of the High Commissioner for India a comprehensive series of exhibits were supplied to the Women's Pavilion at the Glasgow Empire Exhibition; these included posters, pamphlets and cut-out models showing the part taken for relief of disaster and work among women and children.

The Depot distributed a large amount of health and Red Cross propaganda material to provincial, state and district branches, and also to Government departments of health, private bodies, health centres, educational institutions, officials and others.

There were two railway accidents, one in U. P. on the G. I. P. Railway near Bamrauli and the other in Madras on the South Indian Railway near Madura for which the services of nurses on the Red Cross Roll of Trained Nurses for Disasters were offered, but the services were not needed. A grant of Rs. 1,000 was given each to Assam and Bengal for relief work to the sufferers of floods in the provinces. For famine relief measures in Hissar District in the Punjab a sum of Rs. 500 was granted.

Indian ex-service men were assisted as before through the Soldiers Boards. The U. P. Branch paid for the treatment of 17 ex-soldiers suffering from tuberculosis at the Bhowali Sanatorium and the Punjab Branch for giving institutional treatment to 14 ex-soldiers.

ANNUAL REPORT OF THE PUBLIC HEALTH DEPARTMENT IN THE CENTRAL PROVINCES AND BERAR FOR THE YEAR 1937

The year 1937 was comparatively a healthy one. The death rate was 32.63 per thousand of the population as against 34.89 in the preceding year and the quinquennial average 31.98. This is satisfactory as far as it goes, but much leeway has yet to be made up as the mortality rate of the province is still the highest in India. The Provincial Government are convinced of the necessity of a fully-trained and whole-time public health service on which will fall the responsibilities of studying the epidemiological conditions and organizing and supervising such important matters as water-supply, vital statistics, infant and maternal welfare, hygiene and nutrition. As a step in the direction of the expansion of the public health department, Government have made provision in the current year's budget for the appointment of twenty-five sub-assistant health officers, in addition to the present staff. This will give one sub-assistant health officer to each *taluk* in the province.

Although the mortality from malaria during the year fell from 274,670 to 267,558, the disease continued to take a heavy toll, being responsible for 53 per cent of the total mortality from all causes. The evil is so widespread that many people regard it as inevitable and its eradication as impracticable. In reality, however, malaria is neither inevitable nor incurable. Drainage and flushing, oiling of stagnant water and mosquito curtains will prevent it, while quinine will cure it. Prevention is clearly the right policy, but it will take time to bring the disease under control in this province. Meanwhile, Government desire to see no efforts spared to make quinine more easily available and at cheaper rates in all parts of the province.

There is a fall in the mortality from all causes except plague and dysentery. The ravages of plague in recent years have not been so great as in the past, but the public should not be lulled into a false sense of security. If the scourge is to be driven out of the province all local bodies must intensify anti-rat campaigns. The main causes of the major infectious bowel disease of the province, *viz.* cholera, typhoid fever and dysentery, are known to be avoidable and can be traced to bad water-supply, primitive conservancy arrangements and unsatisfactory drainage.

The mortality among infants under one year of age fell from 234.98 per thousand births to 218.16, the quinquennial average being 222.53. The rate is, however, still the highest in India, the lowest being 115.86 in the neighbouring province of Bihar. The main causes of the infantile mortality are prematurity, inanition, malnutrition (chiefly owing to want of mother's milk), diarrhoea, respiratory diseases and fevers. The child welfare and maternity movement, which is making steady progress, is intended to take effective measures to minimize their evil.

Government are greatly concerned about the prevalence of leprosy in the province and are considering the extension of anti-leprosy measures. Four new clinics were opened during the year—two by Government and two by the British Empire Leprosy Relief Association. Provision has also been made in the current year's budget for the establishment of three more leprosy centres. This will bring the total in the province to 40. With a view to organizing public opinion on the subject and carrying on educative propaganda, Government have decided to introduce a scheme for the establishment of district leprosy councils and propose in the current year to open five such councils in the districts where the disease is most widely prevalent.

Correspondence

A NOTE ON SOME CASES OF LATHYRISM IN A PUNJAB VILLAGE

To the Editor, THE INDIAN MEDICAL GAZETTE

SIR,—I have read with much interest Dr. Shah's article on lathyrism cases in a Punjab village and your leader commenting on this article in the July number of the *Indian Medical Gazette*.

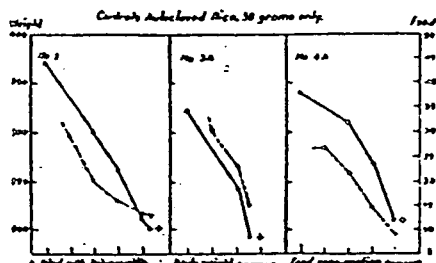
This once more raises the controversy, toxin *versus* avitaminosis, and it is naturally of great interest to me to see that so far as this outbreak goes it appears to support the *akta* theory as originally conceived by Mr. A. Howard (now Sir Albert Howard), at that time Imperial Economic Botanist to the Government of India, and subsequently worked on by Dr. J. L. Simonsen and myself in association with him.

The absence from cultivation or consumption as a foodstuff in the area concerned of *L. sativus* would appear to have definitely exploded the theory that this pulse has a direct causal relationship to the disease, a conclusion which we reached, of course, in 1925, but though the contamination of the wheat with

V. salina provides a tempting and suggestive alternative, this fact, as you point out, unfortunately does not exclude other possible causes such as avitaminosis.

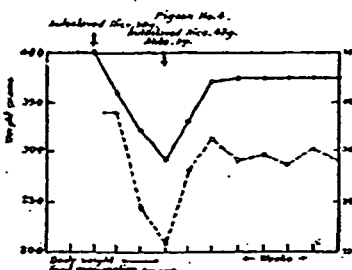
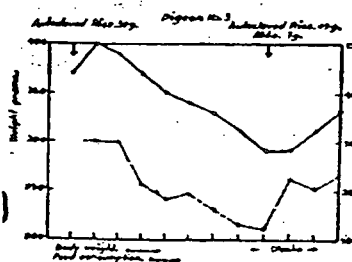
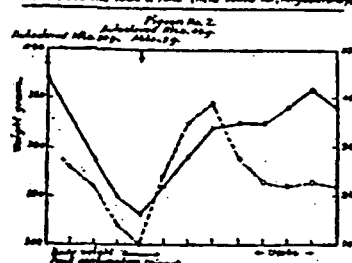
Whilst this question, therefore, still requires an answer I can say with assurance that the disease we produced in animals as a result of feeding them with *akta*—if indeed it corresponds to lathyrism in the human subject—was not due to any lack of antineuritic vitamin in the *akta* seeds.

Owing to the superficial resemblance to polyneuritis columbarum of the disease exhibited by ducks poisoned



by *akta*, we conducted a number of experiments (unpublished hitherto) on pigeons, to determine whether or no *V. salina* was deficient in antineuritic vitamin.

The Antineuritic Value of *akta* Seeds when fed, August 1939.



immediately picked out the raw seeds and how rapidly appetite and consequently the food intake was increased and accompanied by an increase in body weight. None of the birds in this little experiment suffered from the disease we had associated with *akta* poisoning (? lathyrism), either because the quantity of *akta* ingested was too small, or the duration of the experiment was too short. But, of course, the object of the experiment was only to show that the seeds were not deficient in antineuritic vitamin.

Pigeons were fed on an exclusive diet of autoclaved rice, as described by McCarrison, until polyneuritis was fully developed and the birds were at the point of death. At this point a very small quantity of rice was replaced by raw *akta* seeds. The introduction of even as little as 3 g. daily of these seeds rapidly brought about a cure of the polyneuritic symptoms and complete recovery of the birds in four to five weeks. Control birds invariably died after three to four weeks on the exclusive diet of autoclaved rice unless supplemented by the fresh seeds.

Three grams of *akta* seeds, of course, represented only a few seeds scattered among the mass of 50 g. of rice, and it was interesting to see how the sick birds

The accompanying graphs show the result of this experiment with three pigeons and corresponding controls.

The graphs show that the vitamin content of 3 g. of *akta* (pigeon no. 4) is ample to bring about a cure of polyneuritis in pigeons, whilst 1 g. of the seeds (pigeon no. 3) though sufficient to prolong life and bring about an improvement in the condition of the birds, is probably insufficient to establish a complete cure.

Yours, etc.,

L. A. P. ANDERSON,
LIEUTENANT-COLONEL, I.M.S.

PASTEUR INSTITUTE,
SHILLONG,
3rd August, 1939.

DEMANDS OF MEDICAL FEES FROM MEDICAL MEN

To the Editor, THE INDIAN MEDICAL GAZETTE

SIR,—I would very much like your opinion on the subject of fees payable by medical men to other medical men for professional attendance on themselves or their families.

Of specialists who expect, or even demand, a fee one hears much more frequently now than, say, twenty years ago.

Personally, I do not accept a fee. When medical men consult me regarding themselves or other medical men or their families (including widows) and want to know about payment I tell them that the question of payment does not arise. Am I wrong?

I have had occasions to consult medical men in Europe. They have not charged me. From recent accounts given by colleagues, regarding attendance on their families, the position in England, however, does not appear to be clearly defined.

Yours, etc.,
MEDICAL USAGE.

CALCUTTA,
31st August, 1939.

SNAKE BITES AND THEIR TREATMENT IN INDIA

To the Editor, THE INDIAN MEDICAL GAZETTE

SIR,—In the July issue of the *Indian Medical Gazette* a very interesting article 'Snake Bite' by Colonel Chopra and Captain Chowhan was published.

It is mentioned in the article that 'viper' bite prevents clotting of blood, thus encouraging oozing of blood from the nose, vagina and stools, etc.

It is not clear to me why this same viper venom is successfully employed in cases of hæmophilia or bleeders, and allied diseases where the coagulability of blood is delayed or prevented.

In other words, this viper venom is used as a cure for the same disease that it produces. I have in various medical discussions on this side endeavoured to find out a suitable reply to this query, but it has been always asserted that there are two varieties of vipers and the viper whose venom is employed as a cure for bleeders is quite different from the other variety of vipers.

I have to request you to clear this point.

Yours, etc.,

S. A. SUBEDAR, L.C.P.S., S.M.F.

KUTTIYANA,
W. KATHIAWAR,
4th August, 1939.

To the Editor, THE INDIAN MEDICAL GAZETTE

SIR,—With reference to Dr. Subedar's enquiry regarding the anomalous action of viper venom, there had been already a good deal of discussion on its different actions, pharmacologically and therapeutically. In mammalian and human blood both these actions depend on the dose of the venom injected and its concentrations in the blood. To be clearer these different actions may be explained as follows:—

β -Cyano-L-alanine Toxicity: Evidence for the Involvement of an Excitotoxic Mechanism

Dwijendra N. Roy,* Mohammad I. Sabri, Robert J. Kayton, and Peter S. Spencer

Center for Research on Occupational and Environmental Toxicology, Oregon Health Sciences University, Portland, Oregon

ABSTRACT The legume *Vicia sativa* (common vetch) harbors the neurotoxic nonprotein amino acid β -cyano-L-alanine (BCLA) and its γ -glutamyl derivative. BCLA elicits hyperexcitability, convulsions, and rigidity in chicks and rats after oral or intraperitoneal administration, but the mechanism of its action is unknown. The effect of different concentrations of BCLA (0.075–10.0 mM) has been investigated in an organotypic tissue culture system. BCLA concentrations of 0.075 and 0.60 mM had no effect, even up to 6 hr. No changes were observed in cultures treated with 1 mM BCLA for 4 hr. BCLA (2.0–10.0 mM) induces concentration-dependent changes in the explants. The explants display neuronal vacuolation, chromatin clumping, and dense shrunken cells, a pathological response generally seen with excitotoxin. MK-801 (35 μ M), which blocks the open ion channel associated with the *N*-methyl-D-aspartate (NMDA) class of glutamate receptors, attenuates the neurotoxic property of BCLA, while the non-NMDA antagonist, 6-cyano-7-nitroquinoxaline-2,3-dione (10–20 μ M), provides no significant protection. Treatment of isolated mouse brain mitochondria with up to 5 mM BCLA had no inhibitory effect on the activity of NADH-dehydrogenase (complex I) or cytochrome c oxidase (complex IV), a cyanide-sensitive enzyme. These results suggest that the neurotoxicity of BCLA (or derivative) is mediated directly or indirectly through NMDA receptors. © 1997 Wiley-Liss, Inc.

Key Words: *Vicia sativa*; β -Cyano-L-alanine; excitotoxicity; neurotoxicity; glutamate receptors

INTRODUCTION

Vicia sativa (common vetch) is widely cultivated as a food for humans and livestock [Harper and Arscott, 1962] and has been used extensively for soil improvement [Henson and Schotch, 1968]. Several reports indicate that common vetch is toxic to pigs, mules, horses, ducks, monkeys, chicks, and turkey poults [Steyn, 1933]. Ressler et al. [1969] reported that a diet containing 50% *V. sativa* causes 100% mortality in young chicks in less than 1 week. The signs of *V. sativa* toxicity are convulsions, rigidity, prostration, and death.

A neurotoxic amino acid, β -cyano-L-alanine (BCLA) and its γ -glutamyl derivative (γ -glu-BCLA) (Fig. 1) have been isolated and identified from *V. sativa* [Ressler et al., 1963; Tschiersch, 1964; Bell and Tirimanna, 1965]. The levels of BCLA and γ -glu-BCLA in vetch seeds and seedlings on a dry weight basis are 0.6% and 1.7–2.65%, respectively. The toxicological effects of BCLA and γ -glu-BCLA are, however, identical [Ressler, 1962]. The convulsive properties of these two neurotoxic agents were demonstrated in young or mature rats and chicks after subcutaneous injection. Administration of BCLA to weanling male rats through stomach tube produced reversible hyperexcitability, convulsions, and rigidity. High doses of BCLA, given subcutaneously, produce intense convulsions and death. Recently, BCLA and its γ -glutamyl derivative have also been isolated from the fungus *Clitocybe acromelalga*, which causes neurotoxicity [Fushiya et al., 1993].

In Australia, common vetch proved to be an attractive alternate grain legume for dryland farming; its comparatively high seed yields and low production costs stimulated production of this grain. The blanchefleur cultivar of *V. sativa*, originally introduced to Australia as a hay, forage, and green manure crop, was promoted and exported to international grain markets as a cheap replacement for red lentils (*Lens culmaris* Med.) for human consumption [Tate and Enneking, 1992]. Analytical studies at the Australian Grain Academy in Victoria established that the blanchefleur cultivar contains similar levels of BCLA (0.1%) and, perhaps, higher levels (1.1%) of γ -glu-BCLA than those reported for *V. sativa*. Red vetch adulterated with untreated blanchefleur cultivar in international grain market poses a human health threat.

The mechanisms underlying the seizuregenic and neurotoxic properties of BCLA are unknown. One possibility is that BCLA may yield β -aminopropionitrile (BAPN), which in turn has been shown to release cyanide [Froines et al., 1985]. The present study examines the pattern of acute BCLA neurotoxicity in mouse cerebral cortical explants and

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Received 26 June 1996; accepted 28 August 1996.

APPENDIX F

Extracts* & References:

F1. Ian Delaere Ph.D. University of Adelaide (1996) The Chemistry of *Vicia sativa* Selection.

F2. Jane M. Rathjen Ph.D. University of Adelaide (1997) The Potential of *Vicia sativa* L. as grain legume for South Australia.

F3. French CNRS Interne students ex Institute National Agronomique, Paris Grignon, !6 rue Claude Bernard, 75005 Paris : Cecile Malaterre (1994), Pierre Lacarelle (1995), Geraldine Briselance (1996) and Carine Lhermite (1996), Jean Christophe Lepeltier (1997), Sylvie Geraud, (1998), Julien Gennetier (1999).

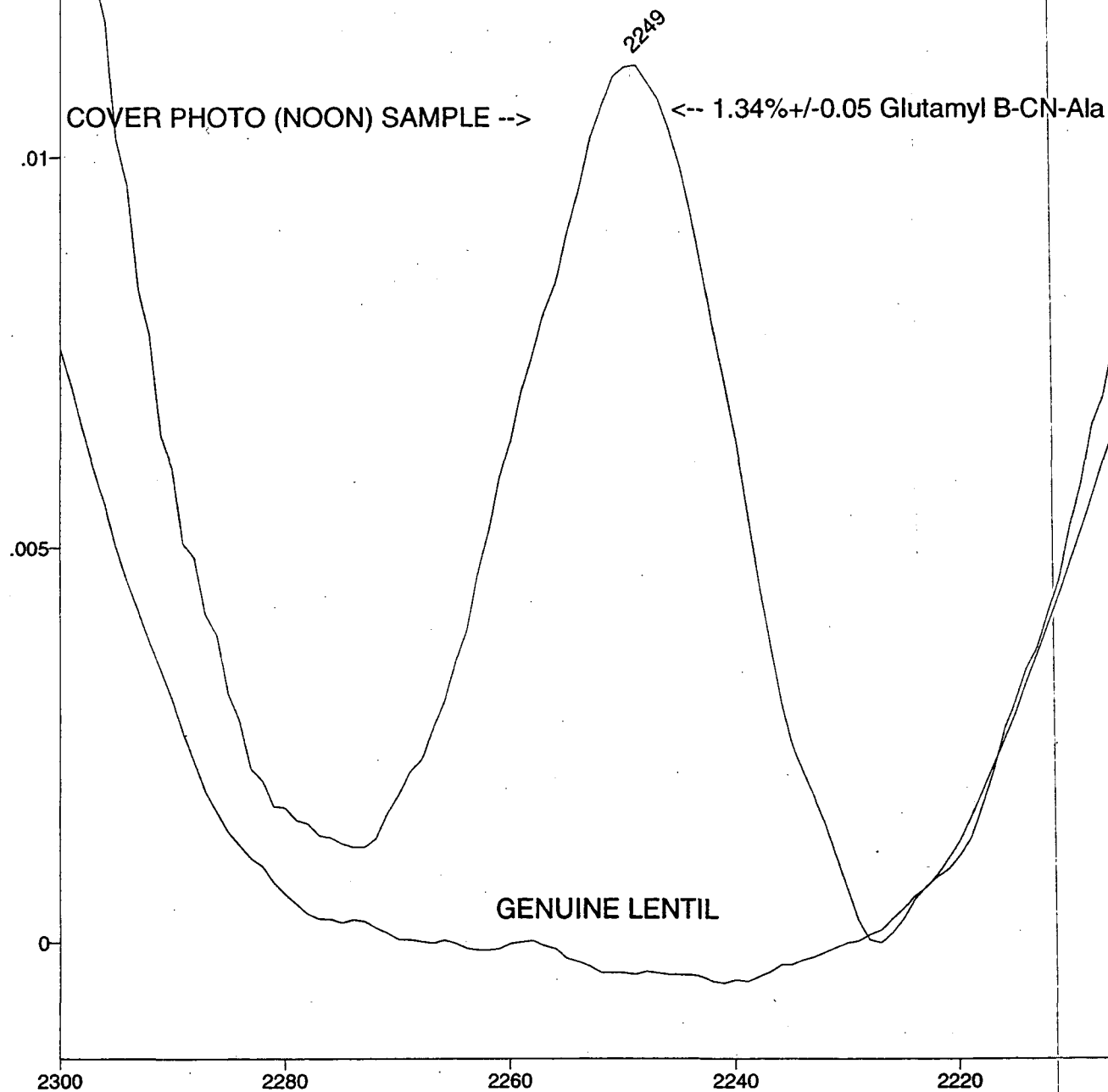
F4. Unpaid Adelaide Casual Volunteers: Dr. Lech Hryniewiecki (1994), Heidi Magar (1996), Robert Asenstorfer (1995-2000)

F5*. Delaere, I., Tate M. E., Jones, G.P. Edward Tiekink, E.R.T., (1995). N- γ -L-Glutamyl- β -cyano-L-alanine, an Antinutritional Factor ex *Vicia sativa* L., as its Ammonium salt, Acta Crystallographica C51, 289-291.

F6*. Tate M. E., (July 1993) Towards the nutritional enhancement of *Vicia* . Legume Digest (ISSN 1037-8537) A grain legume advisory committee (GLAC) publication.

G3*.

IR CN STRETCH IN "BRAZIL LENTIL" ex DHAKA 1996



Absorbance / Wavenumber (cm-1)

Overlay Y-Zoom CURSOR

File # 1 : BRAZ_2

12/9/96 5:23 PM Res=None

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Acta Cryst. (1995). **C51**, 289–291

***N*- γ -L-Glutamyl- β -cyano-L-alanine, an Antinutritional Factor *ex Vicia sativa* L., as its Ammonium Salt**

IAN M. DELAERE AND MAX E. TATE

Department of Plant Science, Waite Agricultural Research Institute, The University of Adelaide, Glen Osmond, SA 5064, Australia

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Department of Horticulture, Viticulture and Oenology, Waite Agricultural Research Institute, The University of Adelaide, Glen Osmond, SA 5064, Australia

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(Received 26 May 1994; accepted 12 August 1994)

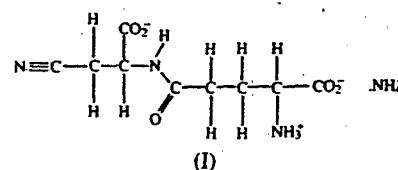
Abstract

The characterization of *N*- γ -L-glutamyl- β -cyano-L-alanine, an antinutritional factor present in *Vicia sativa* L., as its ammonium salt, $\text{NH}_4^+ \cdot \text{C}_9\text{H}_{12}\text{N}_3\text{O}_5^-$, is reported.

Comment

Seeds of the *Vicia* species are known to contain a wide variety of toxic components, some of which have been implicated as causal agents in human and

animal poisoning (Tate & Enneking, 1992). *N*- γ -L-Glutamyl- β -cyano-L-alanine was first isolated as the major biologically active component from *V. sativa* L. by Ressler, Nigam & Giza (1969). It was shown quantitatively to account for the lethality of diets containing 50% *V. sativa* given to week-old chickens, and higher doses showed growth retardant effects in rats. Tate & Enneking (1992) pointed out the unsuitability of the *V. sativa* cultivar Blanche Fleur (which contains 0.5–0.8% *N*- γ -L-glutamyl- β -cyano-L-alanine) for human consumption, which at the time was being exported from Australia as a cheap substitute for red lentils (*Lens culinaris*). Subsequently, the importation of dehulled split Blanche Fleur cotyledons was banned by both India and Egypt. The present report details the X-ray structure determination of *N*- γ -L-glutamyl- β -cyano-L-alanine, characterized as its ammonium salt (I).



The molecular structure of the anion in (I) is shown in Fig. 1. The end of the molecule possessing the C(1) carboxylate group is zwitterionic with the N(1) atom protonated. The charge balance for the C(7) carboxylate group is provided by the ammonium cation.

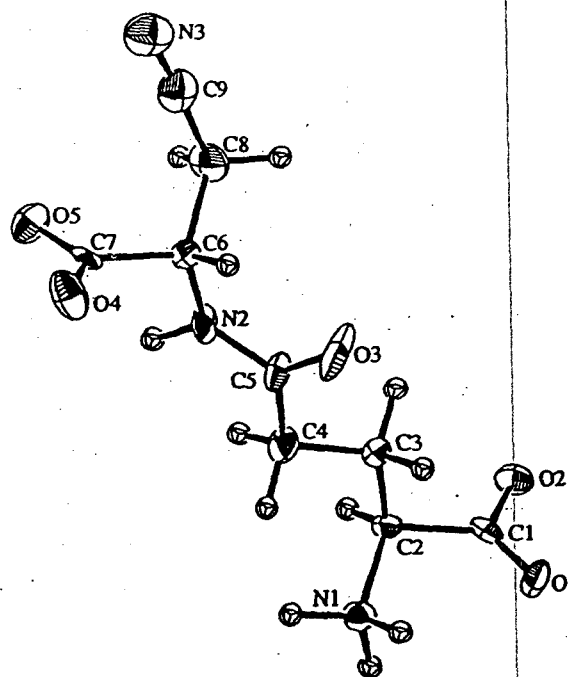


Fig. 1. ORTEP (Johnson, 1976) plot of the molecular structure of the anion in (I) showing 40% probability ellipsoids.

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LEGUME DIGEST

July 1993

Number 6.

A Grain Legume Advisory Committee (GLAC) Publication

Towards The Nutritional Enhancement of Vicia

Dr Max E Tate
University of Adelaide
Waite Agricultural
Research Institute
Dept of Plant Science

Anti-nutritional Factors/Problems

Within grain legumes there are a wide range of anti-nutritional factors (ANF) which have evolved as anti-predator mechanisms. Two well known examples are alkaloids and trypsin inhibitors.

It is not surprising therefore that vetches (*Vicia spp*) have many ANFs which involve various thermostable nitrogenous species. These include the non protein amino acids and their peptides (L-3, 4-Dihydroxy phenyl alanine, Canavanine, β -Cyano-alanine and its γ -glutamyl derivative, the recently discovered S-Ethenyl L-cysteine) as well as the favism toxins vicine and convicine and cyanogenic glycoside vicianine. In some instances the content of these major secondary metabolites can comprise from 1-4% of the dry mass of the seed so they are by no means at negligible concentrations in the unprocessed seed. The toxic properties of these compounds are well documented, however it is also well known that toxicity is a function of both the indicator species and the dosage level, so the food and feed industries prefer to label these compounds as "Anti-nutritional Factors" using the acronym ANFs.

Thermostable ANFs are destroyed by cooking, but consumption of thermostable ANFs must be minimised.

Providing the consumer is aware of the true nature of the product, the deleterious effects of most ANFs can be minimised by processes such as cooking to destroy the thermostable ANFs (such as the trypsin inhibitors) and by leaching (i.e., overnight soaking and discarding the water) to remove the thermostable ANFs. However leaching inevitably results in the loss of desirable constituents such as the water-soluble vitamins and minerals with a net loss of nutritive value. Unfortunately, for genetically predisposed individuals who suffer from favism (predominantly from Middle Eastern countries) the unwitting consumption of residual favism toxins can induce a haemolytic anaemia crisis. It is for this reason that families with a known history of favism are careful to avoid by traditional taboo's, the well known sources of favism toxins such as the otherwise edible faba bean.

What about Blanche Fleur?

Without due consideration to its ANF content, the *Vicia sativa* cultivar Blanche Fleur had, until recently, been promoted for export from Australia as a cheap alternative food to red lentils (*Lens culinaris*). Red lentils which contain no detectable thermostable toxins are part of the staple diet in many pulse eating communities especially around Middle East and the Indian sub-continent. At the Waite Institute we have examined the ANFs present in Blanche Fleur and confirmed the presence of up to 1% of the cyano-alanines and of the favism toxin Vicine. The cyanogenic glycoside vicianine appears to be below the level

of detection. With Grains Research & Development Corporation funding we have now established that it is technically feasible to remove more than 90% of the cyano-alanine by treatment of the split product with suitable approved food acids without substantially altering the attractive pinkish orange colouring of the cotyledons. At the same time there is a desirable decrease in the cooking time of the product. However, Vicine is still present, but at a lower level than is commonly found in the faba bean.

What Now?

Now we have a situation, wherein we know how to nutritionally enhance a Vicia crop in a technically feasible way. However, before that crop can be regarded as being suitable for human consumption it is necessary that a maximum level of cyano-alanines be approved by our National Food Authority here in Australia. At present as no limit has been prescribed, no cyano-alanines are allowed in vetch or indeed other foods intended for human consumption. This issue needs to be addressed.

The Cost

In the opinion of those few people I have discussed this problem with, it could cost from \$200,000 to \$1,000,000 to conduct all toxicology testing needed to meet these regulatory requirements.

We now have a recurring financial predicament which will continue to affect the grain export industry whenever another hitherto unfamiliar legume export for human

consumption is proposed and here I am thinking of both Lathyrus and the Narbon bean. The industry should be well aware of how much time, money and effort has already been spent on lupins and be prepared to learn from past successes as well as errors.

What should be done?

It seems to be generally understood, that in spite of the agronomic benefits which accrue from growing legumes, the real profits lie with food grade products. I suggest that for any future new food-grade grain legume commodity, that in order to assess how much in the way of future resources should be diverted to fundamental and applied research as well as marketing, it would make good sense right now, for the government and industry to get together and give detailed consideration to the history of lupins as a well known case study.

This would help assess the current and future potential contribution to the Australian economy of hitherto unrecognised food grade legumes. If Australia is to duplicate the Canadian success with canola, we cannot afford to postpone these decisions until we have suitable value added post harvest procedures or we have bred Lathyrus and Vicia species with low or nil levels of thermostable ANFs.

Editor's Note

Some important issues have been raised. We welcome correspondence. In the meantime we will pursue the National Food Authority regarding regulatory issues and provide comment in future issues of the Digest.

Australian Grain Legume
Sample Displays
Dr Jan Mahoney
Department of Agriculture
Epsom, Victoria

In 1988 the Victorian

Department of Agriculture produced 100 folders of grain legume samples which was so successful that an additional 300 were produced and quickly bought by the trade.

Grain legumes are now an integral part of cropping in Australia and earn an average of \$250m in exports per year.

The Victorian Department of Agriculture decided to build on the success of the Victorian sample folders by developing a similar one for grain legumes produced in Australia. This was strongly supported by the Grains Council of Australia (GCA) and the grain legume industry. The Grains Research and Development Corporation was approached and provided some funds for the production of the displays. The displays have been developed in consultation with other State departments and some members of the trade who indicated which legumes should be contained in the folder and provided samples.

The displays contain samples of seed and a range of local names which assist to clarify discussions with buyers from different countries. The use of local names in conjunction with the samples on the previous displays was reported as being of particular use by the traders. There is also a section of grains which are currently developing but are expected to be available in the near future; this section will also provide feedback to the Australian industry that there are markets for these new products.

The aim of the display is to promote Australian grain legumes throughout the world. Traders found the previous Victorian display extremely helpful in promoting the product, ensuring mutual understanding of the product under discussion and bringing it to the notice of new customers. The display helps keep the range of Australian grain legumes to the forefront

of buyers minds to consolidate our position in current markets and access new markets.

The GCA will assist to distribute the display throughout the industry in Australia and passed on to a worldwide network of buyers. The folders are available to the industry at a cost of \$35.00 which will be used to fund the production of more folders as required. It is important to be able to update the folders as new crops and varieties come into production.

The displays were developed by Dr Jan Mahoney, Regional Manager North West Victoria and Mark Drum from the Victorian Institute for Dryland Agriculture, Horsham and orders may be placed by contacting Dr Mahoney on telephone (054) 403 712.

Lupin Food Research Boosted

The Grain Pool of W.A. has awarded a research grant to a local company, Lupin Processing Limited to support the continuing development of products for human food applications, derived from the lupin.

The \$50,000 grant will assist with the establishment of a pilot plant for the production of dietary fibre for commercial evaluation in Australia. The Grain Pool will also assist the company in the development of markets for the residual protein material associated with extracting fibre from the cell wall of the lupin seed. Information on a number of potential applications will also be exchanged and markets identified for further commercial evaluation.

Correspondence or enquiries should be directed to:
B R Cox, Secretary
Grain Legume Advisory
Committee
GPO Box A24, Perth WA 6001
PH: (09) 481 0959
FAX: (09) 481 3553

APPENDIX G

Extracts* & References:

G1*. Cowling, W.A. and Gladstones, J.S. (1999) Lupin breeding in Australia. *in* Current Plant Science and Biotechnology in Agriculture. Vol. 34, 541-547. Linking Research and Marketing Opportunities for Pulses in the 21st Century. R. Knight Ed. (Proceedings of the Third International Food Legume Research Conference, Adelaide 1997) Publishers Kluwer Academic Publishers, Dordrecht/Boston/London

G2*. Nelson, P. and Hawthorne, W.A. (1999) Development of lupins as a crop in Australia. *in* Current Plant Science and Biotechnology in Agriculture. Vol. 34, 549-559. Linking Research and Marketing Opportunities for Pulses in the 21st Century. R. Knight Ed. (Proceedings of the Third International Food Legume Research Conference, Adelaide 1997) Publishers Kluwer Academic Publishers, Dordrecht/Boston/London

G3*. Diffuse reflectance IR of *Vicia sativa* and Lentils (*Lens culinaris*) from Dhaka markets (Cover photo, noon sample).

G4*. Regenerated *Vicia sativa* from Dhaka markets (Cover photo, noon sample).

G5*. Tate, ME (1996) Vetches: Feed or Food?, Chemistry in Australia, **63**, 549-550

G6*. Steene, M. (April 4 1997) Exporter found Guilty of false-labelling charge. Adelaide Advertiser.

G7a*, 7b*. Original and altered Bills of lading from Adelaide to Johore and Johore to Colombo.

G8*. Ressler, C. Tatake, J.G. Kaizer, E. and Putnam, D.H. (1997) Neurotoxins in a vetch food: Stability to cooking and removal of γ -Glutamyl- β -cyanoalanine and β -cyanoalanine and acute toxicity from Common vetch (*Vicia sativa* L.) legumes. J. Agric. Food Chem. **45**, 189-184.

G9*. Qualitative Premakumara TLC of Adelaide vetch exported to Colombo as red lentils.

LUPIN BREEDING IN AUSTRALIA

W A Cowling¹ and J S Gladstones²

¹ Senior Plant Breeder, Agriculture Western Australia, Locked Bag No. 4, Benlley Delivery Centre, WA 6983, Australia, ² Consultant, 27 Pandora Drive, City Beach, WA 6015, Australia

Abstract

The lupin industry in Australia is based largely on *Lupinus angustifolius*, the narrow-leaved lupin. This species was developed as a new crop in Australia by J S Gladstones in the 1960s from semi-domesticated *L. angustifolius* introduced from Europe. The genes for low alkaloid content (*iuc*) and soft seeds (*moll*) were available in the Swedish forage variety Borre. Spontaneous mutants with white flowers and seeds (*leuc*) and non-shattering pods (*le* and *ta*) were found in the bitter landrace New Zealand Blue. These were recombined with *iuc* and *moll* to release the first commercial sweet varieties Uniwhite (1967) and Uniharvest (1969). However, it was not until early flowering (spontaneous mutant *Ku*) was found in Borre and recombined to produce the variety Unicrop (1973) that the narrow-leaved lupin became a viable crop for the main cropping regions of southern Australia. Breeding since that time has focussed on developing disease resistance, and concurrently yield and quality. Resistance to grey leaf spot (*Stemphylium vesicarium*) in Marri (1976) and Illyarrie (1979) and resistance to Phomopsis stem blight (*Diaporthe toxica*) in Gungurru (1988) and Merrit (1991) were major breakthroughs in the development of the crop. The role of wild lupins in these genetic advances was paramount. Genetic advances in yield of narrow-leaved lupins from Unicrop (1973) to Merrit (1991) occurred at an average rate of approximately 2% per year. Breeding and testing of lupins in Australia is funded partly by industry funds through a nationally co-ordinated project. All new varieties must contain less than 0.02% alkaloids on average. In addition to *L. angustifolius*, *L. albus* cv. Kiev Mutant has been very successful on more fertile loamy soils. A low alkaloid and early flowering variety of *L. luteus*, cv. Wodjil, was released in 1997 and is adapted to very acid sands in low rainfall areas. Breeders are also domesticating new lupin species such as *L. atlanticus* and *L. pilosus* for more alkaline and loamy soils. The greatest challenge facing breeders at present is the urgent need for anthracnose resistance.

INTRODUCTION

Lupins have become an important crop in southern Australia, especially in Western Australia where the climate and most soils are well suited to the production of the narrow-leaved lupin (*Lupinus angustifolius* L.) (see Nelson and Hawthorne, this volume). However, when lupin breeding began in Australia in the 1950s, the future role of *L. angustifolius* was not obvious and early breeding and testing covered many species including *L. albus* L., *L. luteus* L. and *L. cosentinii* Guss. (Gladstones 1994). The former two were domesticated in Germany before and after World War II (discussed in Cowling *et al.* 1998) and early varieties were introduced to Australia in the 1950s. *L. cosentinii* proliferated as a wild plant after accidental introduction to Western Australia in the mid to late 1800s, where it was later used as a pasture species on poor sandy soils (Gladstones 1994).

Most of the introduced lupin varieties in the 1950s were too late flowering and maturing for successful production in the wheatbelt of Western Australia. Also, *L. albus* was not adapted to the predominant infertile sands of Western Australia and *L. luteus* cv. Weiko III suffered from drought stress and severe virus diseases and insect attack. *L. angustifolius* grew well, especially in higher rainfall regions, and when natural mutants were found with non-shattering pods and early flowering, this species became a focus of the breeding effort. The final steps to domestication of *L. angustifolius* and the entire domestication of *L. cosentinii* occurred in the Western Australian breeding program (Gladstones 1994).

This paper describes the breeding of lupins in Australia since the 1950s with the emphasis on the most widely grown species, *L. angustifolius*.

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The displays were developed by Dr Jan Mahoney, Regional Manager North West Victoria and Mark Drum from the Victorian Institute for Dryland Agriculture, Horsham and orders may be placed by contacting Dr Mahoney on telephone (054) 403 712.

Lupin Food Research Boosted

The Grain Pool of W.A. has awarded a research grant to a local company, Lupin Processing Limited to support the continuing development of products for human food applications, derived from the lupin.

The \$50,000 grant will assist with the establishment of a pilot plant for the production of dietary fibre for commercial evaluation in Australia. The Grain Pool will also assist the company in the development of markets for the residual protein material associated with extracting fibre from the cell wall of the lupin seed. Information on a number of potential applications will also be exchanged and markets identified for further commercial evaluation.

Correspondence or enquiries should be directed to:
B R Cox, Secretary
Grain Legume Advisory Committee
GPO Box A24, Perth WA 6001
PH: (09) 481 0959
FAX: (09) 481 3553

P. Nelson¹ and W.A. Hawthorne²

¹ The Grain Pool of Western Australia, GPO Box A24, Perth, W Australia; ² South Australian Research and Development Institut, Naracoorte, S Australia 5271

ABSTRACT

In just twenty years, a new crop plant, *Lupinus angustifolius* has been developed to become a major cropping industry in Australia. This occurred as a result of a successful project of research and development undertaken mainly in Western Australia (WA). It involved plant breeders, agronomists, marketers, farmers and extension personnel. This paper documents the development and highlights the benefits of research and development occurring concurrently.

Before the development of lupins, cropping systems in WA involved either continuous cereal or pasture/cereal rotations. Problems with weeds and diseases were prevalent. Lupins are now the cornerstone of many farming systems in Australia, especially WA where there is a predominance of acidic, sandy soils. Lupins are an economic crop in their own right and provide benefits to other crops in terms of weed management, nutrition and disease breaks which lead to higher yields. Lupins play a vital role in the successful integration of stock and crop enterprises on many farms. Development of varieties, which are resistant to the fungus, *Phomopsis leptostromiformis* has reduced the risk of the disease lupinosis in sheep.

In 1996, 1.5 million hectares of lupins were grown in Australia as a grain crop and earned US\$190 million of export income with a further estimated value of US\$120 million being generated from sheep feed and increased cereal yields. It is forecast that varieties of *Lupinus angustifolius* will be cultivated on 2 million hectares before the year 2005. A national research and development program continues to develop better varieties of *L. angustifolius*. In addition other lupin species are being developed which are more suited to the heavier and the finer textured soils and also very acid soils.

In 1996 for the first time, the serious disease anthracnose (*Colletotrichum gloeosporoides*) was recorded in commercial lupin crops. Strategies are now in place to eradicate or minimise the effects of this disease through quarantine, plant breeding and agronomic practices. *Fusarium oxysporum* has not been recorded in lupin crops and perhaps the anthracnose experience will strengthen our resolve to prevent this disease entering Australia.

INTRODUCTION

The state of Western Australia (WA) has led the way in the development of the Australian lupin industry, and has consistently sown some 85% of the Australian lupin area. The area lies between latitudes 27°S and 35°S and is subject to a Mediterranean climate with mild wet winters and hot dry summers. Rainfall varies from greater than 750 mm in the south-western corner of the state to less than 300 mm in the eastern and northern agricultural areas. The main cropping areas lie in the 450-mm to 300-mm rainfall zone. In the eastern states (South Australia, Victoria, New South Wales and to a lesser extent Tasmania), the main cropping areas extend to 38°S, and rainfall to 600 mm.

The soil types on which lupins grow well predominate in WA, and are acidic and sandy surfaced. Many are deep sands or sands over gravel or clay at varying depths. Other pulse species grow poorly on these soils, which are infertile in the virgin state and subject to wind erosion when bare of plant cover. Lupins however, have also been found to grow well on heavier textured, acidic soils in eastern Australia.

In Australia, broad scale farming has relied on wheat and wool production for most of its income. The cereal and sheep areas have about 110 million sheep and 19 million hectares of crop. Before 1970, farming systems often involved multiple cropping of wheat on the more loamy or heavier soils. However, on sandy surfaced soils, a ley farming system was practiced, whereby the land was in pasture for three or four years

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IR CN STRETCH IN "BRAZIL LENTIL" ex DHAKA 1996

COVER PHOTO (NOON) SAMPLE -->

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2249

<-- 1.34%+/-0.05 Glutamyl B-CN-Ala

.005

GENUINE LENTIL

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2300

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2260

2240

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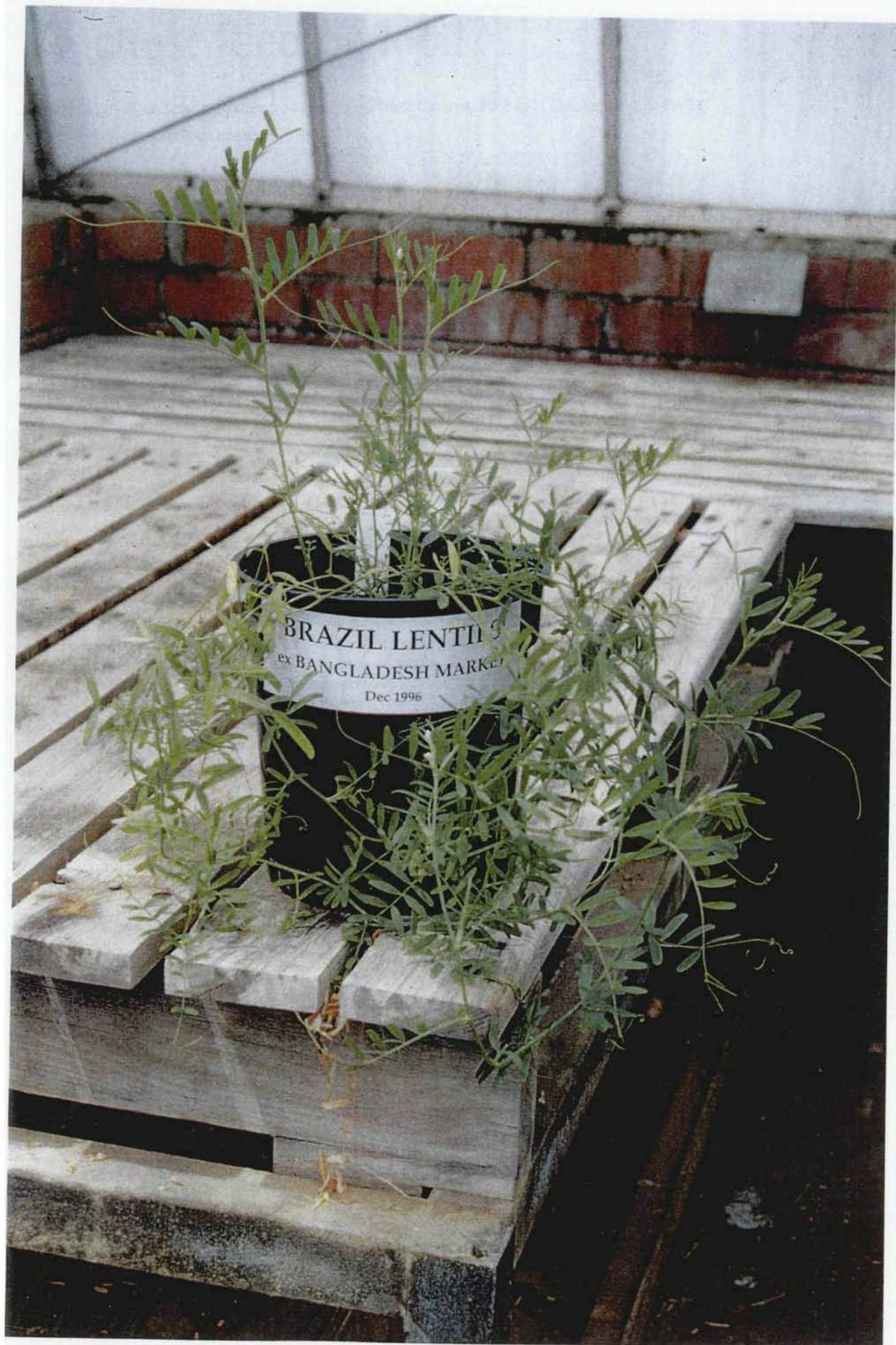
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MAX E. TATE MRACI

Vetches: feed or food?

Department of Plant Science, University of Adelaide, Waite Campus, PO Bag 1, Glen Osmond, SA 5064

Email mtate@waite.adelaide.edu.au

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Vetches as feed

Toxicity to biological species is a function of toxin dosage. In accordance with that generalisation, Lepkovsky pointed out that "The most frequent defence used by animals against toxic compounds is to limit their food intake, so that ingestion of the compound is reduced to nontoxic levels."¹

Vetch anti-feeding factors have now been identified using Lepkovsky's concept. Vetches, members of the *Vicia* species, were introduced to Australia by E.T. Bailey of CSIRO in the 1940s as alternative leguminous rotation crops to field peas (*Pisum sativum*). The vetches were mainly sourced from arid areas of the Middle East and after selection some were readily adapted to our Mediterranean-type soils and climate of southern Australia. They continue to play an important role as versatile rotation crops for forage, hay making, feed and as green manure.

The late Richard Davies, a veterinarian at the then S.A. Department of Agriculture, drew my attention to the fact that Namoi vetch (*Vicia villosa* Roth), contained a factor – present in the seeds – that would cause a pig to starve itself to death, rather than continue to eat feed containing as little as 8% of Namoi vetch seed. Cows gorging themselves on *Vicia villosa* grain had been reported to show acute toxicity symptoms,² hence although ruminants safely graze the plant as forage, they can be affected at high dosages by the toxin in the seeds.

Classical extraction, purification and crystallisation of the potent Namoi vetch toxin coupled with Richard Davies' pig-feed intake assay soon established that it was the well-documented arginine analogue L-canavanine causing the problem.³ How

does it work? A clue was in the bioassay.

When Namoi vetch was fed to pigs, the first feed was consumed without problems; the next feed intake was always depressed. Nitric oxide derived from the guanine group of arginine is known to play an important role in the control of blood pressure in rats by the relaxation of aortic rings but it also acts to control peristalsis. We have therefore hypothesised that the delayed feed intake inhibition is due to the inhibition of nitric oxide-mediated peristalsis by canavanine acting as an arginine look-alike. Support for this hypothesis can be inferred from a report by Thomas and Rosenthal of constipation in rats fed canavanine.⁴

Readers contemplating that a daily dosage of canavanine might be a good way to control obesity should take note of a report of the unfortunate consequences of regular daily consumption of canavanine-containing alfalfa-seed tablets.⁵

The Blanche Fleur vetch as food fiasco

In December 1991, our laboratory was approached by a concerned grain-legume exporter seeking our approval for the export for human consumption

of Blanche Fleur, a common vetch (*Vicia sativa* L.) cultivar, as a cheap substitute for the red lentil (*Lens culinaris* L.). It had already been sold and labelled as such "at the buyer's request". Market research had previously found it to be visually acceptable to Mediterranean and Indian subcontinent importers as a cheap substitute for the red lentil. The figure shows how the light-orange colour of "split" Blanche fleur vetch cotyledons (Fig. 1, lower LHS) can be enhanced with a light coat of vegetable oil (Fig. 1, lower RHS) to look remarkably like a cheap substitute at \$400/tonne for the genuine red lentil (\$800/tonne, Fig. 1, upper dish). In 1989, only 50 tonnes of Blanche Fleur vetch was exported from South Australia, but by the 1991–92 season our farmers showed just what could be done with a marketable cash crop and produced a harvest of 20,000 tonnes.

Unfortunately, those who promoted common vetch as food had not examined the chemical literature prior to 1970. In 1969 Charlotte Ressler published detailed chemical investigations on the isolation and identification of two related neurotoxins from *Vicia sativa*, namely β -cyano-L-alanine and its γ -L-glutamyl dipeptide.⁶ Furthermore,

she had shown that a diet of either 50% of common vetch or its cyanoalanine equivalent in a control diet was sufficient to shorten the average survival time for week-old chickens to just one more week, and the growth of rats was also retarded.

Once it had been independently confirmed that the cyanoalanine toxins were present at about 1% dry weight, i.e. 1 g for every 100 g plateful of unleached Blanche Fleur vetch, it became clear that we had a potentially serious problem on our hands. Consumers

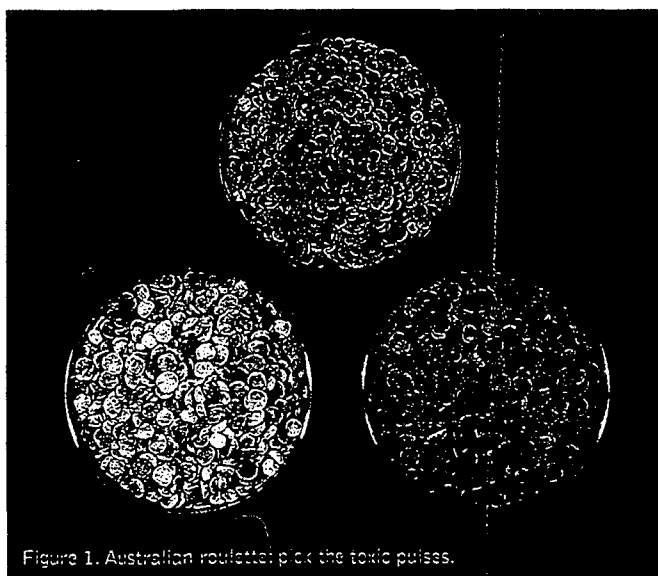


Figure 1. Australian roulette: pick the toxic pulses.

cooking vetch in the same unleached manner as traditionally used for lentils would receive an approximate dose of 0.5 g per 100 g raw vetch. The grant-funding body was informed at a meeting on the Waite Campus in January 1992. I then queried Simon Crean in Canberra, who referred it to Alan Griffiths, about any evidence that Blanche Fleur was suitable for human consumption. In addition, two warning letters were sent to the S.A. *Stock Journal* to try and convince the local farming community prior to planting that there was a problem.

After receiving a reply from Alan Griffiths which stated that "it is not possible to provide affirmation that the cultivar (Blanche Fleur) is fit for human consumption", I knew we had a real problem.

The older literature was replete with references to the toxicity of *Vicia sativa* to animals including poultry and monkeys and in one instance as a possible causal factor for neuropathy in humans. However, there was no unequivocal evidence for acute toxicity in humans; nevertheless it had been confiscated by police in Berlin during World War I.

The size of the problem can be imagined when you consider that 100,000 tonnes equates to one billion 100 g platefuls! I therefore forwarded a commentary article to *Nature* entitled "A mess of red pottage", which was accepted and published on 1 October 1992.⁷ This brought instantaneous results and produced extensive secondary international media publicity, along with local front page coverage in the *Melbourne Age*.

A very irate grains industry described myself and student Dirk Enneking as "irresponsible" scientists; this adjective was crossed out in a fax forwarded to me by the ABC *Country Hour* program.

What did the international scientific community think?

India promptly banned the importation of *Vicia sativa* early in 1993 as did Egypt shortly after, and then the market collapsed. The Australian Legumes Committee attempted to justify its stance in subsequent correspondence to *Nature*^{8a} which was juxtaposed beside a letter from E.G. Brown of the University of Swansea.^{8b} Brown pointed out that although we had correctly drawn attention to the cyanosalanine problem, it was a particularly unfortunate situation that

large quantities were being sold as lentils to the Middle East where favism (a genetically determined and sometimes fatal haemolytic disease) is caused by the consumption of the pyrimidine glycoside vicine in some *Faba* beans (*Vicia faba*). Unlike lentils, *Vicia sativa* and *Vicia faba* both contain vicine. The Australian industry response^{8a} was strongly rebutted by workers at the Indian Council of Medical Research in Hyderabad.⁹

In December 1992 I received a letter from Dr Dan Putnam in Minneapolis who had been engaged as an expert witness in a court case wherein an Egyptian grain importer was suing a large US company for selling him a "slow cooking lentil" which his customers had complained about. Genuine lentils cook in less than 15 minutes, whereas *Vicia sativa* does not readily soften until boiled for an hour or more. After reading our article, and receiving reference samples of the purified toxin and authentic *Vicia sativa*, Dr Putnam's suspicions that he might actually be dealing with *Vicia sativa* were ultimately confirmed. However, in this case the *Vicia sativa* had been sourced from China and not from Australia. Dr Putnam accumulated an impressive dossier on the subject and the case was ultimately settled out of court in 1995 for over US\$2 million in favour of the Egyptian plaintiff.

Predictably, and because of the collapse of the multi-million dollar Blanche Fleur export industry in 1992-93, I was "invited" to defend my position on three separate occasions. The friends of Max Tate were usually conspicuous by their absence at those meetings. After the second "enquiry", the tenor was set the next day (31 March) in an article in the *Victorian Weekly Times*: "Scientists cripple vetch industry". Four weeks later (28 April 1993) the same paper published a decision by the Grains Council of Australia to declare *Vicia sativa* "as unsuitable for human consumption".

What has happened since?

Fortunately, there has been an exponential rise in the production of genuine lentils, thanks to the release of well-adapted local cultivars by the South Australian Research and Development Institute.

However, in 1995 *Vicia sativa* continued to be exported from Australia to the Indian subcontinent in bags labelled

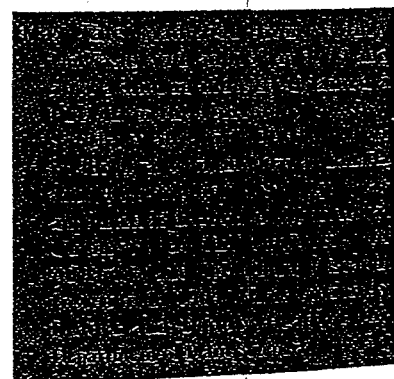
not suitable for human consumption. Once there, *caveat emptor* reigns and it continues to be repackaged and sold in the markets. As pointed out in a report from a farmers' group from Birchip in Victoria, this poses a potential threat not only to the health of the unwitting consumers, but also to the fledgling, genuine, Australian red-lentil industry. Can Australia breed a low- or zero toxin vetch?

Can Australia breed a low toxin vetch?

With financial support from the Grains Research and Development Corporation through the Centre for Legumes in Mediterranean Agriculture in W.A., and three enthusiastic students Ian Delaere, Jane Rathjen and Robert Asenstorfer, the available *Vicia sativa* germplasm banks have been screened for low-toxin accessions. About 20 promising parental lines have been identified out of about 3000 examined to date at the Waite campus. With good collaboration from all interested parties, perhaps the zero toxin *Vicia sativa* "OZ pea" will be a cheap new food legume for vegetarian societies in the next millennium and provide Australia's answer to the Canadian canola.

References

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Neurotoxins in a Vetch Food: Stability to Cooking and Removal of γ -Glutamyl- β -cyanoalanine and β -Cyanoalanine and Acute Toxicity from Common Vetch (*Vicia sativa* L.) Legumes

Charlotte Ressler,*† Jayant G. Tatake,† Ellen Kaizer,† and Daniel H. Putnam‡

Department of Pharmacology, University of Connecticut Health Center, Farmington, Connecticut 06030, and Department of Agronomy and Range Science, University of California, Davis, California 95616

Because the neurotoxic common vetch (*Vicia sativa* L.) legume seems to have come into some use in man's diet, we have investigated, using Pico-Tag analysis, the stability of the vetch neurotoxins to cooking. When heated in water at 100 °C for 3 h, γ -glutamyl- β -cyanoalanine (γ -gluBCA) cyclized extensively to form pyroglutamic acid and β -cyanoalanine (BCA). By contrast three specimens of common vetch seeds containing 0.42–0.74% γ -gluBCA and 0.01–0.03% BCA retained these principles without loss. A modified cooking procedure replacing the broth during cooking with fresh water and washing the seeds well yielded cooked seeds without detectable neurotoxins. A nutritional study confirmed that the toxins responsible for causing weight loss and mortality in chicks were removed. Lengthy steeping in water at room temperature also effectively removed the neurotoxins from dehulled split seeds but incompletely from intact seeds. These procedures improve the quality of common vetch seed as a source of protein for man.

Keywords: Common vetch; *Vicia sativa* L.; legumes; nutrition; chicks; food toxins; detoxification; β -cyanoalanine; γ -glutamyl- β -cyanoalanine; pyroglutamic acid

INTRODUCTION

Seeds of common vetch (*Vicia sativa* L., CVS) have appeared recently on the commercial food market as an inexpensive surrogate of the lentil (*Lens culinaris* L.) to which it bears considerable physical similarity (Tate and Enneking, 1992). However, CVS is highly neurotoxic to the young chick (Harper and Arscott, 1962; Ressler et al., 1963) due to a neurotoxin that is present as dipeptide γ -glutamyl- β -cyanoalanine (γ -gluBCA, 1) and to a lesser extent as the free amino acid, β -cyanoalanine, (BCA, 2). In feeding experiments with the chick, the acute toxicity of the seed has been correlated with the total content of BCA, with both forms of BCA having similar acute toxicity on a molar basis (Ressler et al., 1969).

In the interest of evaluating the suitability of CVS as a source of food for humans, we have examined the stability of the neurotoxins under ordinary conditions of cooking. The stability of purified BCA and γ -gluBCA to the hydrolytic conditions of cooking was examined first. Because other components in the seed, possibly carbohydrate, might influence the stability of the toxins, the effect of cooking on the toxin concentration in the seed was then determined using three separate specimens of CVS. In addition to assessing stability, these experiments furnished information on the ability of several procedures to remove the neurotoxins. These procedures included cooking with several decantations of the broth and steeping in water at room temperature, as well as steeping followed by cooking. To validate the chemical findings that indicated detoxification, the processed cooked vetch was then fed to chicks.

MATERIALS AND METHODS

BCA was synthetic material (Ressler and Ratzkin, 1961). γ -GluBCA-DCHA had been prepared from material isolated from CVS (Ressler et al., 1969). These had melting points 219–220 °C dec and 184–185.5 °C dec, respectively, close to those reported. γ -GluBCA was a gift from Dr. Max E. Tate. The compounds were homogeneous on TLC, paper electrophoresis, and amino acid analysis (*vide infra*). Pyroglutamic acid and 3,3',5,5'-tetramethylbenzidine were purchased from Sigma (St. Louis, MO). Splits of specimen L, subsequently determined to be *Vicia sativa* (Putnam et al., 1994), originated from seeds reportedly grown in China and imported to Egypt as "red round lentils" (H. Kerien and B. D. Johnson, private communications). Splits of specimen P were purchased in 1992 as "masoor dahl" in a local ethnic food store in Minneapolis and were identified as *Vicia sativa* (Putnam et al., 1994). Common vetch seeds, "pea vetch", specimen C, were purchased from Seedway, Inc. (York, PA). Grown in Canada, "C" was thought to be an improved variety (Willamette) of common vetch but was undocumented (F. S. Mohr, Jr., private communication). One-day old White Leghorn chicks of unspecified sex were obtained from Spafas, Inc. (Preston, CT).

Analyses for protein, fat and fiber were performed by Woodson-Tenent Laboratories, Inc. (Memphis, TN).

Extraction and Amino Acid Analysis (AAA). Extraction of pulverized seed was carried out with 30% EtOH in the cold overnight as described (E-1; Ressler et al., 1969) or modified (E-2) by extracting twice with 20 vol of 30% EtOH with centrifuging and washing, each time with 20 vol of solvent. After a third extraction, the residue was removed by filtration and washed well. The combined extract and washings were concentrated and taken up in water (15 mL/g of seed). Extracts were stored frozen until analyzed. Before derivatization the solution was clarified by centrifugation and an aliquot was ultrafiltered.

AAA was by Pico-Tag analysis involving pre-column derivatization with phenyl isothiocyanate (PITC) followed by HPLC (Cohen et al., 1989). The sample was converted to its base with triethylamine (NEt₃), subsequently treated with 10% PITC-NEt₃ in aqueous methanol for 20 min, and evacuated finally at <100 mTorr for 18 h. Chromatography was on a Rainin 15-cm Microsorb C-18 (5 μ) column, using two Waters

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Exporter found guilty of false-labelling charge

By MARK STEENE

One of Australia's leading exporters has been fined \$3000 for shipping South Australian vetch to Sri Lanka disguised as lentils.

Family company Societa Cofica Pty Ltd, based at Melbourne's World Trade Centre, pleaded guilty in the Adelaide Magistrates Court to four counts of breaching Australian export laws.

Lentils are about twice as valuable as the vetch variety of legume on the world market.

The court was told that the company was listed in the top 150 exporters in Australia and had an annual turnover of \$35 million.

The company was charged with knowingly applying a false trade description to goods intended for export between July 1 and October 13 last year.

Mr Ross Christoforou, prosecuting, said that, after Australian Quarantine and Inspection Service officers had been notified vetch was being exported as lentils, they visited a processing plant at Wingfield.

Under questioning, the Wingfield

plant's proprietor admitted putting the vetch in 50kg bags and labelling them as lentils.

Six shipping containers were each loaded with 430 bags and sent in three shipments to Colombo, Sri Lanka.

Mr Christoforou said the processing plant's proprietor had claimed he undertook all work on behalf of the company in Melbourne and under instruction from the company.

A search warrant had been executed at the company's offices in Melbourne and the managing director, Mr Dia Ram Sharma, had agreed he had directed the processor to apply the labels to the bags.

Mr Edwin Clark, for the company, said the vetch was labelled as vetch when shipments began, and the label was changed at the insistence of the Sri Lankan buyer.

He said Societa Cofica Pty Ltd did not receive any additional revenue from the re-labelling and had made \$3534.97 gross profit from three shipments, operating on a 2 to 3 per cent profit margin.

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陽明海運股份有限公司

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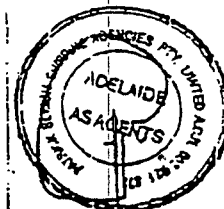
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Port of Discharge COLOMBO, SRI LANKA		Place of Delivery	
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PARTICULARS FURNISHED BY SHIPPER

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		SIX (6) X 20FT FCL CONTAINERS EACH CONTAINING 860 X 25KG BAGS RED SPLIT VETCH (AS PER BENEFICIARY'S PROFORMA INVOICE DATED 27MAR98) - 129 METRIC TONNES	129516 KGS GROSS 129000 KGS NETT 162 CUBIC METRES
		L/C NO.DC JBU980207	
CONTAINER NO./SEAL NO.	NETT WEIGHT	GROSS WEIGHT	CUBIC METRES
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INBJ 3315839 / YMX384384	21500 KILOS	21586 KILOS	27
YML J 2517634 / YMX384372	21500 KILOS	21586 KILOS	27
YML J 2484206 / YMX384350	21500 KILOS	21586 KILOS	27
CRXJ 2683727 / YMX384360	21500 KILOS	21586 KILOS	27
YML J 2457392 / YMX384357	21500 KILOS	21586 KILOS	27

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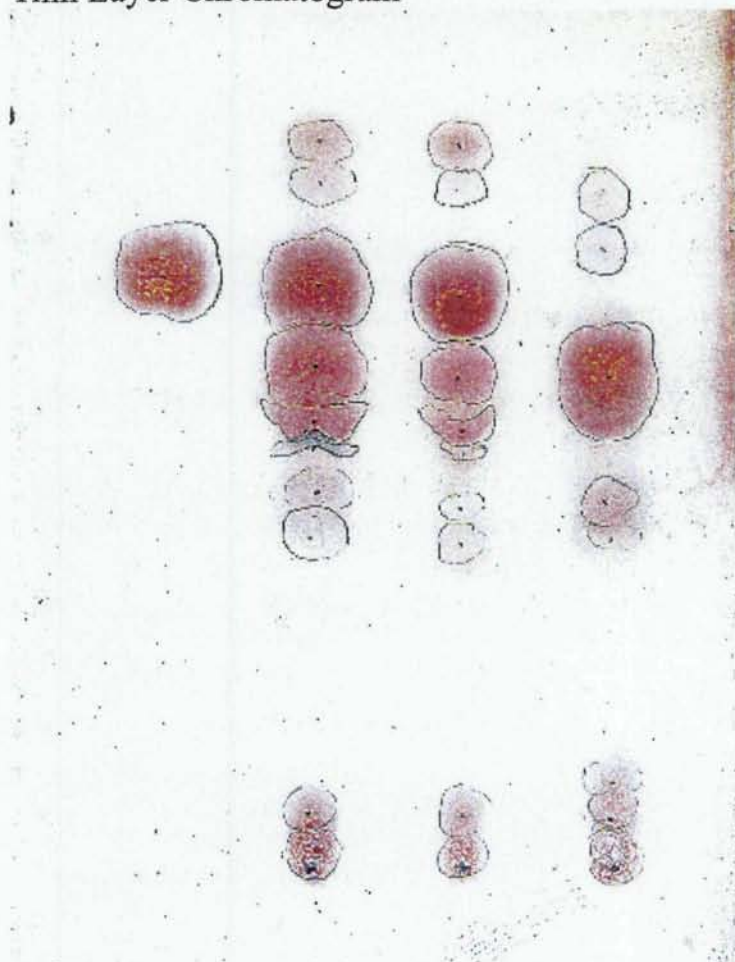


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ITEM NO	QTY	RATIO	PER	UNIT	PREPAG	COLLECT	BL NO	 PATRICK SLEIGH SHIPPING AGENCIES PTY. LIMITED AS AGENTS FOR THE CARRIER YANGMING MARINE TRANSPORT CORPORATION				
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A simple Thin Layer Chromatography Method to distinguish between vetch (*Vicia sativa*) and lentil (*Lens culinaris*).

Data provided by Dr. S. Premakumara, NPDG/CISIR, Sri Lanka

Thin Layer Chromatogram



A B C D

A = Toxin (gamma-glutamyl-beta-cyanoalanine)

B = Authentic Vetch

C = Sample given by the client

D = Authentic Lentil

Thin layer chromatography (TLC) can clearly differentiate Vetch and Lentils. Vetch has a clear blue green band, which is completely absent in Lentil TLC profile. This band is beta-cyanoalanine, a breakdown product of gamma-glutamyl-beta-cyanoalanine formed during extraction.

Both the free beta-cyanoalanine(green/blue) and the gamma glutamyl derivative (track A, major red/purple) have the same toxicity on a molar basis. The major component in both vetch samples is the dipeptide form of the toxin.

The method used is as follows :

APPENDIX H

Extracts* & References:

H1*. Email cc. support (October 28 1998) from Director (John Hamblin) of CLIMA (Centre for Legumes In Mediterranean Agriculture), W.A.

H1b* Reply from Tim Fischer MP. Canberra (November 11 1998)

H2*. Sri Lankan Newspapers, cf (<http://www.general.uwa.edu.au/u/enneking/VETCH.htm>).

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(<http://www.abc.net.au/rn/talks/8.30/helthrpt/stories/s22429.html>)

H4*. Tate, M. E.; Rathjen, J.; Delaere, I., and Enneking, D. (1999). Covert trade in toxic vetch continues. *Nature* **400**, 207,

H5*. Reply from Mark Vaile MHR, Canberra (March 22 1999)

H6*. Pakistani vetch email (June 18 1999)

H6b*. Pakistani Newspapers (November 11 1999)

H6c*. Pakistani Newspapers (Dec 8 1999)

H7*. Bangladesh Sample of "Australian lentil (*V. sativa*) ex Dr. M.M. Rahman.

H7b*. Dhaka Bangladesh Newspapers (October 16 1999), cf
(<http://www.general.uwa.edu.au/u/enneking/VETCH.htm>).

H8*. Reply from Patrick Cole, The Department of The Prime Minister and Cabinet . Canberra (November 23 1998)

H9*. Pulse Australia Memo (March 19 2000).

H10*. De Maria W. (1999) Deadly disclosures: whistleblowers and the ethical meltdown of Australia. p. 21, Wakefield Press, 17 Rundle St., Kent Town, South Australia 5071.

28 October, 1998

Minister for Trade, Mr T. Fischer
The Prime Minister, Chairman of Supermarket to Asia

Dear Prime Minister,
Dear Minister of Trade

I write to support the Dr. Max Tate's concerns about vetch seed (*Vicia sativa*, cv Blanche Fleur) being exported from Australia and ending up overseas as lentils, which I believe will be reported in tomorrow's Australian.

There are considerable risks to Australia's food trade from this type of activity, particularly if it can be shown to be a deliberate attempt to disguise one product and sell it as another. This could have disastrous implications where the product contains a substance that may cause human health problems.

I recognise that our jurisdiction only applies within Australia and that this raises considerable difficulties for authorities, but the implications from the export of these vetch seeds have wide ramifications and affect farmers and exporters in Australia and importers and consumers in the country of importation.

I hope the information supplied by Dr. Tate and further investigation ensures that this type of substitution can be eliminated in the future. If we cannot do this we will damage to our reputation as a clean / green food producer and the Supermarket to Asia project will be seriously undermined. We must be able to ensure our products in importing countries are as stated. If we cannot do this it will have a major effect on our lentil industry.

Yours sincerely

John Hamblin
DIRECTOR

HAMBLIN/LETTER/17VETCH



H1b*.

THE HON TIM FISCHER MP

DEPUTY PRIME MINISTER

MINISTER FOR TRADE

LEADER OF THE NATIONAL PARTY

Dr Max E Tate
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CRAFERS SA 5152

10 NOV 1998

Dear Dr Tate

Thank you for your letter dated 28 October 1998 addressed to both myself and the Minister for Foreign Affairs, Mr Downer, raising concerns about the export of vetch in the light of the recent impoundment by the Sri Lankan Customs Authority of two shipments of vetch sourced from South Australia. As this matter fits more appropriately within the Trade portfolio, I am responding to your letter on behalf of Mr Downer also.

The issues you raise are timely. As you note, the risk of mislabelling vetch as red split lentils poses not only a major health concern, but also could potentially damage Australia's leguminous export trade more generally given the adverse publicity arising from the recent cases.

As you may be aware, in the case in question the Australian Customs Service investigation found the Australian exporter complied with all the export requirements. Documentation at hand clearly demonstrates the exporter correctly described the contents of the consignment, to both the Australian Customs Service and the shipping company, as vetch.

Nevertheless, the fact that mislabelling of vetch as red lentils has occurred on several occasions in the past does raise the broader issue of whether stricter controls should be imposed on the export of vetch. I am therefore referring a copy of your correspondence, and my reply, to my colleague, Mr Vaile, Minister for Agriculture, Fisheries and Forestry, who has portfolio responsibility for AQIS.

Yours sincerely

TIM FISCHER MP

Customs seize six container loads of animal feed to be sold as Mysore Dhal

by Manjula Fernando

Customs officers recently sealed a warehouse of a Pettah trading company which allegedly imported six container loads of animal feed for human consumption, under the pretext that they were red split lentils (Mysore Dhal).

The food which is suspected to be 'Vetch', an animal food, contains a toxic called 'Toxin' which can harm a section of the brain and could impair vision, custom sources told the Daily News yesterday.

According to sources, the alleged consignment weighing 129,000 kilogrammes was worth US \$ 78,690 (about Rs.5.2 million). The importer had also enjoyed a duty waiver of over Rs. 1 million at the Customs counter that is given for Dhal importation.

Food inspectors at the Customs Department have referred the food samples to the Ceylon Institute of Scientific and Industrial Research (CISIR) and another sample will be sent to the Adelaide University in Australia for further analysis on Thursday.

"We are expecting the results of the analysis by Saturday. If the test indicates it is 'Vetch', the goods will be destroyed and legal action will be taken against the importer," sources said.

Investigations have revealed that documents pertaining to the imported goods had been switched in Malaysia to indicate that they were red split lentils, whereas the original documents from Australia described the goods as Red Split Vetch.

The Customs officers had been vigilant on information by the Australian authorities that there was an organised racket to traffic animal food to Third World countries for human consumption.

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Radio National



the health report

with Norman Swan
on Monday 19/04/99

Vetch Scandal

Summary:

Australian farmers and companies have been exporting thousands of tonnes of a potentially toxic legume which looks a bit like a split lentil, to impoverished countries, sometimes deliberately mislabelled.

Transcript:

Norman Swan: Welcome to the program. Today: why eminent researchers are saying that banning DDT will kill millions of people.

And, a scandal that's been going on for years despite the efforts of one scientist.

Australian farmers and companies have been exporting thousands of tonnes of a potentially toxic legume, which looks a bit like a split lentil, exporting it to impoverished countries, sometimes deliberately mislabelled.

Largely as a result of a seven year battle by an Adelaide plant scientist, the Australian government has just installed tighter controls. It's an attempt to limit serious damage to our reputation as a safe food exporters, but in fact, as you'll hear, there's still nothing to stop the actual exports continuing.

The plant is called vetch. But I'll let this scientist, Dr Max Tate, tell you more about it.

Max Tate: Vetch is a pea-like plant which like pea, is a legume, and it's very high in nitrogen. And the vetch has been around for thousands of years. In the old days it was used in England and Europe extensively as stock feed.

Norman Swan: It's still used to feed cattle, but overseas vetch is a cheap substitute for lentils. The trouble is that it contains a toxin called cyanoalanine, which can build up in the brains and livers of non-ruminant animals.

What Dr Max Tate claims to have found over the years, are repeated attempts to mislead buyers into believing that the product is actually lentils for human consumption.

The latest episode a few months ago, involved a South Australian exporter who shipped the vetch correctly labelled, during transit an independent middle person seems to have renamed the consignment as lentils.

Vetch was introduced into Australia as a rotational crop to put nitrogen back into the soil and also, as you heard, to provide hay and feed for cattle. And this is one reason why many farmers have been beguiled by vetch, because it doesn't harm ruminants who can detoxify the poison. The problems, says Dr Tate, arise in animals with a single stomach, like you and I, or chickens and pigs.

Max Tate: Most of this work was done in the 1960s. In the case of chickens, they are particularly susceptible and if you feed it to one-week old chickens, by the end of the next week most of them would have a hard time getting out an insurance policy, let's put it that way. Rats will lose weight, they won't gain weight at the same rate as control rats and the chickens will die.

Norman Swan: Is there any evidence of human toxicity? Whilst there's plenty of laboratory evidence of animal toxicity, is there any evidence that people came to harm as a result of this export industry?

Max Tate: As far as we can see, there's no reliable evidence to date for acute toxicity in humans, and I suspect that those people who are well fed and have the occasional meal of vetch without causing major problems. But if you do as we did and follow what happens to the toxin when it's consumed, you find that in pigs, which are the closest mimic for homo sapiens, then we see that there's a steady build-up of an analogue of glutathione which is an important constituent in animal tissues.

Norman Swan: So a chemical similar to that builds up in the brain, and presumably could do harm, which is a concern.

Max Tate: Yes, and it's a cumulative thing.

Norman Swan: The only human evidence is circumstantial, based on an unusual epidemic of plant toxicity in India in the 1920s.

In about 1992, Max Tate was shocked to discover the extent to which vetch was being sold overseas instead of, or sometimes disguised as, red lentils, a staple part of many poor nations' diets.

Max Tate: It was being exported on a massive scale; it had gone from 50 tonnes in 1988/89, to 20,000 tonnes in 1992, and it was primarily going into India, Egypt, the Middle East, and various other Third World countries.

Norman Swan: And why were farmers selling this, when as you have pointed out, people have known for decades that this contains a toxin?

Max Tate: Well I can only assume that the people who were first involved in promoting it, didn't read the literature. I don't blame the farming community at all, because they simply were told that they would receive a good price for this material. Samples have been taken to India and the Middle East, and shown to the importers there, and they were very impressed with the fact that at that time, lentils were \$US800 a tonne, and this material could be supplied to them for less than \$400 a tonne.

Norman Swan: But you call this a substitution racket; was it being exported as lentils for dahl and so on? How was it being exported from this country? What was the scandal in your view, apart from the fact that 20,000 tonnes of potentially toxic vegetable materials —

Max Tate: Well, it was being sold and labelled at the importers' request as red lentils, which it definitely was not.

Norman Swan: And it could get away with this because it looks like red lentils when it's split.

Max Tate: When it's split and they added another flourish by coating it with a thin layer of vegetable oil which darkens it up from the pale orange colour of vetch to make it a fair approximation in appearance to that of the red split lentil.

Norman Swan: In the early '90s, Dr Tate wrote to a South Australian trade paper warning farmers about the problem, but was heavily criticised for his efforts by the Grains Council of Australia.

Nevertheless he hung on and published a scientific review in the prestigious international journal, *Nature*. And then it was on for young and old, because Dr Tate claims that article directly led to the partial collapse of the vetch industry.

Max Tate: The local publicity was extremely bad, and I was pilloried on radio programs and the like at that time.

Norman Swan: So why did the market collapse?

Max Tate: It collapsed because India banned its importation, Egypt banned its importation and so did Saudi Arabia which were the three major markets at that time.

Norman Swan: What's been happening since then, because the saga continues?

Max Tate: Yes, the saga does continue. I thought that I'd done my bit and it wouldn't arise again, but to my great surprise, in 1997 there was a court case here in Adelaide where a Melbourne company was again exporting vetch in bags labelled 'Red Split Lentils'. That continued on; I had correspondence with scientists in Bangladesh. I received samples from there and it was clearly vetch, but it was being sold as Brazilian lentils in Dacca.

Norman Swan: Is there any chance that common vetch was diverted into the Australian market for Australian consumption as red lentils?

Max Tate: For a very short period of time before I became actively involved, I had been told by chefs of one kind or another around Adelaide, that it was being sold as orange lentils in Adelaide.

Norman Swan: We all buy orange lentils to make soup with. How can we tell the difference?

Max Tate: Well, with great difficulty, although I must say that every time I go to the supermarket on a Saturday morning, I scan the shelves to see whether anyone is bold enough to start selling it again. But I must say that over the years since 1993, I have not been able to find a genuine sample of vetch being sold in a supermarket anywhere here.

Well it might not be sold anywhere here, but according to one exporter I spoke to, in South Australia Alone there are probably 20,000 tonnes of vetch grown for human consumption overseas, in countries like Pakistan and Sri Lanka.

For people in poverty, a split pea that looks exactly like the real thing but at half the price is quite an attractive proposition, it's main practical drawback being that it cooks far more slowly than proper red lentils. And as Dr Tate implied earlier, no-one knows the extent to which it's

toxic to humans.

Just a few months ago, another substitution scandal emerged involving Australian vetch, and it has threatened the now large red lentil export industry and our image as an environmentally green producer.

The Health Report is in possession of two Bills of Lading, shipping documents, describing a shipment from a South Australian company of 129 metric tonnes of what they called red split vetch, a correctly labelled consignment, to Colombo in Sri Lanka. But somewhere down the line, in transit, a third party changed the Bill of Lading to read 129 tonnes of red split lentils.

This caused an enormous public furore in Sri Lanka, so much so that the Minister for Trade, Tim Fischer, became involved, as did the Minister for Agriculture, Mark Vaile, very concerned about our reputation overseas.

Max Tate: The lentil industry now has reached in tonnages the size of the vetch industry in 1992. But the value is infinitely more because it's a high quality product, and one of my major complaints about this whole situation is that these cowboys are damaging our clean and green image and is making it very difficult to actually sell genuine lentils, because people think substitution is continuing, which it was, right up to September last year.

Norman Swan: Australian exporters and producers can't hide behind the notion that they're selling the vetch for stock feed because they're receiving twice the price that stock feed sells for; in other words they're benefiting from the premium for human food.

Max Tate's point is that even correctly labelled, there's a moral issue here in the vetch industry because they're selling a potentially poisonous product.

Max Tate: Yes, basically this is the whole crux of the matter and why I'm still active on the scene, even though I'm now retired. It is an abomination that what is a perfectly genuine industry should be compromised by people who are out to make a short-term profit with no thought to the consequences of their actions.

Norman Swan: What's happened since in terms of government action?

Max Tate: Well I'm pleased to say that Mr Mark Vaile has -

Norman Swan: That's the Primary Industry Minister.

Max Tate: Yes. Has indicated that vetch and lentils and certain other grains have been declared to be proscribed grains, in an enactment of an amendment to the appropriate Act.

Norman Swan: And what does that mean?

Max Tate: Well that means if a grain is proscribed, it must be inspected to make sure that it is phyto-sanitary, i.e. it contains no weeds or insects, and that the trade description complies.

Norman Swan: So that complies, but how does that change the situation where you might have an importer in another place relabelling it. Does it make it any better, does it make it any more difficult to do that?

Max Tate: It still makes it a problem, you're quite right, the material can still go out labelled as whole vetch.

Norman Swan: Why don't we just ban whole vetch exports?

Max Tate: I would think that there's certainly a number of people in the community who would be agin that. If I had the opportunity I would do that, but there's a legitimate sale of material for stock feed, or indeed in Europe, there is a large area of vetch to be planted; they may well want our well adapted high yielding varieties in places like Spain.

Norman Swan: So will the new gazetting make any difference then to the basic problem which is that we could still be exporting toxic material for human consumption overseas, and the economic implication being that we're threatening a very large industry here.

Max Tate: I agree that there's a problem, but it's now a manageable problem in that people such as myself can monitor how much is going out, where it's going to, and we can then check to see what's happening in the country.

Norman Swan: Dr Max Tate, who's visiting scientist at the University of Adelaide's Department of Plant Science.

References: Export Control Act 1982, Grain Plants and Plant Products Orders Amendment 1999

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Bhat R.V. and Raghuram T.C. Health and economic implications of imported toxic legumes; *Current Science* 1993; 65:12-13.

Tate M. And Enneking D. A Mess of Red Pottage: Commentary, *Nature* ; 359:357-358.

Well the grains industry, in a dramatic turnaround from its antagonistic position six years ago, has welcomed the moves by the Minister to give the Australian Quarantine Inspection Service, AQIS, the right to inspect export lentils and vetch to ensure quality and correct labelling.

But there is still an issue to be confronted when a considerable amount of vetch is produced each year for human consumption.

Alan Hunter is Chairman of Pulse Australia, which represents our legume industry.

Alan Hunter: Because of the difficulty in telling the difference between split vetch and split lentils, some countries, such as Sri Lanka, have banned the imports of both, and what we needed to do was to assure these countries and these importers, that in fact what they were getting was in fact what was on the bag.

Norman Swan: How much vetch is under cultivation in Australia?

Alan Hunter: There's about 40,000 hectares of vetch planted each year.

Norman Swan: An exporter in South Australia told me that in South Australia alone there's probably 20,000 tonnes being produced; in Victoria, 40,000, and probably the same again in New South Wales. That's a lot of vetch.

Alan Hunter: I'd suggest that that's higher than it is, but it depends on the season. It's primarily used as a grazing crop. It's harvested, it's normally used for just birdseeds and the livestock industry.

Norman Swan: But a lot of it is being exported for human consumption.

Alan Hunter: Well, not that we know of.

Norman Swan: Well this exporter was telling me that there was a large batch in his factory being prepared, and he knew of lots of other exporters who were preparing vetch for export and was suggesting that there were many thousands of tonnes being exported, not mislabelled, correctly labelled as vetch, but for human —

Alan Hunter: ... referring to human, you know, split, but whole vetch is exported, that's official and it's exported for primarily the livestock industries.

Norman Swan: Well, he denied that. He was saying he was getting \$300 to \$450 which is the price for human consumption. In other words, he was saying that he is exporting many thousands of tonnes and he knows lots of other exporters who are as well, of split vetch, correctly labelled as split vetch, he's not mislabelling it as red split lentils, but he's exporting split vetch for human consumption and getting the price that you would expect for human consumption; that it wasn't illegal and he's not doing anything wrong because he's correctly labelling it.

Alan Hunter: Well, you're quite right, I mean that isn't illegal, and that's quite OK. The problem we have is that as long as that label stays on it and isn't changed anywhere, I would suggest that that threat is only to our lentil which has got a much bigger potential than the vetch market for human consumption.

Norman Swan: Nonetheless, we still have a lot of people exporting it. Isn't there a moral issue here, that we're exporting large amounts of a potentially toxic legume overseas, that we wouldn't dream of selling for human consumption in Australia?

Alan Hunter: True. The best we can do is to make sure that it's correctly labelled, and to make sure that there's some independent body like AQIS, that's required to give it that label or that tick of approval as it leaves, so that at least the people who are eating it, know they're eating it.

Norman Swan: We'll come back to the moral question, but there is also a practical question here, that you might export it labelled as vetch, but a middle person might re-label it, but it's still sourced as Australian, and just simply because of the volume of vetch that we are exporting, just simply because we're exporting vetch for human consumption, we are putting the lentil industry at risk.

Alan Hunter: Yes.

Norman Swan: Shouldn't we just ban vetch altogether for export, for human consumption?

Alan Hunter: Look, you know, in fact Pulse Australia isn't about trying to make more laws and restrictions. For obvious reasons the policing of it and all sorts of things. We'd rather just put the strategies in place where we eliminate the risks as much as possible, because even if you make it illegal, there's usually a way around it if the market price, the rewards are sufficiently good enough.

Norman Swan: Presumably you represent vetch growers, given that you're Pulse Australia, you represent vetch growers as well as lentil growers.

Alan Hunter: Yes, we do.

Norman Swan: So you're in a difficult position.

Alan Hunter: Well, not really, but if it's wrong to do, it's wrong to do, it doesn't matter whether it's vetch or lentils. But we do have a small industry, we are trying to protect all sections of that industry, and we're trying to keep our options as wide as we can for growers to grow whatever crops they choose, for marketers to buy those crops and put them in to whatever markets they can. If we're putting one part of the industry at risk because of some inadequacies on another side, well we'd rather pick up the inadequacies rather than to ban it altogether.

Norman Swan: Are you recommending that vetch growers replant with lentils?

Alan Hunter: No, I'm suggesting that vetch growers beware of the high prices. If it's suspicious that the product that they're growing is making more money, is returning more than it would be otherwise be expected to make on the livestock markets, then we've got to be careful we don't cut our nose to spite our nose. In other words, the lentil industry might one day be a lot better and a lot bigger because the crops are grown in similar areas, that they might lose out in the end.

Norman Swan: It must be pretty tempting if you're a grower and somebody offers you \$180 a tonne for stock feed but you'll get \$350 or more for human consumption.

Alan Hunter: Oh, we'd do well to know the company and the countries to which they're going, and because they're now included on the list of proscribed grains, we get to know all that information, so we've got more handle on it than we would have if we hadn't have taken that action.

We're getting there, but there's a whole lot of ways to skin a cat I suppose and we try the least regulation track as our first choice.

Norman Swan: And just finally, what's your view now six years on? I mean the Grains Council, which you are linked with, was very violently opposed to the scientific news of the toxicity potential of vetch when it came out in the journal *Nature* six years ago from Dr Max Tate. Do you now regret that opposition that was expressed there really very strongly?

Alan Hunter: Well it's not position to criticise another organisation, and had obviously given it their full attention at the time, I wouldn't say, and I'm not responsible for it, I wasn't responsible then and I'm not now, so I'm not regretting anything. I think time has moved on; we know now that while there's a strong argument that the evidence that Dr Max Tate had presented was not conclusive, and varies. On the other hand no conclusive evidence that what he presented was wrong, and I think time has proven us to be perhaps over-reacting to Max's warnings, and I think as we've matured, as an organisation the pulse industry, Pulse Australia wasn't around, that's six years ago, as we've matured, as we've discussed it, as we've worked through the issues, we've come to a logical conclusion. We've got much more to do of course in the industry, and in terms of these sorts of issues, but yes I think it's a maturation process and I wouldn't like you to get the impression that I'm criticising Grains Council because I think they were doing what they thought at the time to be in the best interests of the industry.

Norman Swan: Alan Hunter, look thank you very much for coming on to The Health Report.

Alan Hunter: My pleasure.

Norman Swan: Alan Hunter is Chairman of Pulse Australia, not the usual kind of pulse taken on The Health Report.

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Covert trade in toxic vetch continues

—The Commentary "A mess of red vetch" by two of us¹ exposed the export from Australia of seeds from toxic common vetch (*Vicia sativa*) as a cheap substitute for the edible red lentil (*Lens culinaris*). Despite efforts to this trade in the wake of our article, the problem has recurred.

Dietary cyanoalanine neurotoxins from vetch accumulate in the brains and livers of pigs, rats and poultry. Effects on sulphur metabolism result in urinary excretion of methionine and accumulation of the non-functional glutathione analogue glutamyl- β -cyanoalanyl-glycine.

G. Brown² pointed out that the genetic predisposition towards favism in Mediterranean communities makes this doubly unfortunate, because common vetch contains the favism toxin vicine.

After our Commentary was published, India and Egypt banned, and Saudi Arabia restricted, imports of vetch. The *Victorian Weekly Times* published articles entitled "Scientists cripple vetch industry" and "Vetch unfit for humans to eat". The A\$18 billion (US\$11.7 million) market collapsed.

But last year we were alerted by the Sri Lankan Health Department of the problem's

re-emergence. Unlabelled bags of split red vetch (240 tonnes) had been exported from Adelaide via Johor in Malaysia to Colombo. On arrival, the container documentation had changed from "red split vetch" to "red split lentils". This event was extensively reported in the *Sri Lankan Daily News*³, but was ignored by the international media.

In April 1999, a report on Australian ABC radio⁴ gave details of the multi-thousand tonne vetch/lentil substitution racket. The export price (A\$340–400 per tonne) leaves no doubt that the bulk is sold for human consumption. Exports (in tonnes) from South Australia for the first four months of 1999 include: split vetch to Yemen (22) and United Arab Emirates (194); and 'whole vetch' to Argentina (10), Bangladesh (989), Belgium (187), Germany (63), Italy (149), Japan (120), Mexico (40), The Netherlands (124), Pakistan (903), The Philippines (22), Portugal (106), South Africa (42) and Taiwan (86).

From these data, and the sale of unlabelled split red vetch in the markets of Pakistan and Bangladesh, we conclude that either it is being split in the importing country or it is being split in Australia and

exported labelled as whole vetch.

When cooked (without leaching) in mistake for red lentils, 1,000 tonnes of vetch gives ten million 100-g platefuls, each containing 0.5 g of cyanoalanine toxins. The harmful effects of vetch consumption in animals are known, but the effects on humans are not. Most at risk are malnourished vegetarian societies with sulphur-deficient diets.

To protect a valuable and expanding lentil industry, the Australian government moved swiftly (7 April 1999) to declare both vetch and lentils as prescribed grains. This means that inspection and phytosanitary certification are mandatory before export. Unfortunately, the financial rewards to exporters and importers are still too high to eliminate this dishonest trade.

Max E. Tate*, Jane Rathjen, Ian Delaere, Dirk Enneking

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*Visiting scientist

1. Tate, M. E. & Enneking, D. *Nature* 359, 357–358 (1992).
2. Brown, E. G. *Nature* 340, 9 (1992).
3. <http://www.lanka.net/lakehouse/archive.html> (8 October 1998).
4. http://www.abc.net.au/rn/talks/8_30/belknapstories/22429.htm

Valuable biodiversity data under threat

Sir—Your report¹ on the move by the Burke Museum of Natural History and Culture to become independent of the University of Washington, Seattle, because of a lack of financial support from the university, illustrates one of the threats facing university biodiversity collections.

The Burke museum has the advantage of size to make plausible its becoming an independent institution. But curators of smaller, yet important, collections often face a similar financial crunch that cannot be solved by becoming independent. They face the option of minimal management of their collections, sometimes through out-of-pocket support, or of allowing the institutions to become orphaned.

Orphaned collections are not transferred to an institution interested in their care, the result is a tragic, irreplaceable loss of biodiversity data. That is certain to lead to the decline of university training in systematic biology, which depends on collections. These and other factors contribute to what is aptly called "the crumbling infrastructure of biodiversity"². It is to be hoped that universities will recognize that their biodiversity collections

are as important a component of the infrastructure for biological sciences as electron microscopes and ultracentrifuges. Angelo Capparella

Department of Biological Sciences, Illinois State University, Normal, Illinois 61790, USA

1. Dabson, R. *Nature* 399, 189 (1999).
2. Winkler, K. *Cons. Biol.* 10, 703 (1996).

Global e-journal must take radical approach

Sir—Much nonsense has been written about the 'E-Biomed' initiative to launch a global website for much of the biomedical literature, announced by Harold Varmus, director of the US National Institutes of Health (NIH). If it were the case that the present system had served science well for 300 years, for example, the outrage over the present state of scientific publishing felt in some quarters would not exist (see *Nature* 398, 735 & 399, 292; 1999).

Happily, dialogue has been under way worldwide for some time, involving people from various disciplines, to investigate how electronic publishing can reach the broadest possible audience. Some new model will emerge from this process. Harmonization of goals and means is difficult, and benefits

greatly from the involvement of a broad pool of perspectives and contributions. In this setting, the Varmus initiative is welcome, as are the critical evaluations to which the proposal will be subject.

Some of the valid concerns are the preservation and organization of materials; cataloguing; provenance (whether to peer review); copyright; and economic impact (including access in less developed countries). To advance the 'E-Biomed' proposal, I suggest that a moderated listserv is set up to initiate documentation and development of the larger community of interest. The NIH would be an appropriate host. These groups should be encouraged to participate: authors and researchers; archivists and librarians; Internet specialists; publishers and professional organizations; and readers.

I am initially mistrustful of what appears to be (largely) an electronic replication of existing methods of publication. One possibility is that 'E-Biomed' could host papers vetted by 'alternative' editorial boards, whose composition would be publicly stated, and whose editorial manifesto would be published, but whose membership would not be controlled by a central governing board.

Lance Sultzbaugh
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18 June 1999

H6*.

Dr. Max E. Tate
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South Australia.

Dear Max

I am writing to you for an important problem, which I trust is also of your interest. Recently, I have been approached by an influential government agency, which is buying large quantity of splitted lentil (dal) through contractors. Among samples one sample was sent to the said agency as imported lentil dal, which was passed on to me for confirmation. With reference to your papers, the sample appears to be doubtful and could be vetch. However, it is not possible to confirm it without your technical assistance.

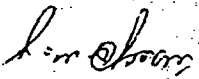
I will be grateful if you could analyse the sample at your earliest.

Thank you very much.

My best regards for my supervisor Dr. Glenn K. McDonald and other friends of Waite.

Hoping to see you in Pakistan in near future.

Yours sincerely


(Habib ur Rahman Khan)
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Agriculture & Agri Exports/Imports

Government bans vetch import from Australia for health reasons

..... ISLAMABAD (November 11) : The government has banned the import of vetch, a kind of pulse which has resemblance to red lentil i.e. 'Masoor'.

.....The vetch – an animal feed – contains one percent neurotoxins, which is harmful for human consumption. According to medical experts, it causes blindness, incapacitates the brain and breeds arthritis.

.....A market survey reveals that unscrupulous businessmen were found selling vetch imported from Australia in place of 'Masoor ki dal', having a large local consumer market.

.....Lentil is fondly consumed as a staple dish by Pakistanis, as well as the other nations of Middle East and South Asia, while it is sparingly consumed elsewhere in the world.

.....In Pakistan, the annual production of lentil is 30,000 tonnes while its demand is around 60,000 tonnes. Lentil is, therefore, imported from Iran, Turkey and Australia.

.....Instead of import of lentil, the unscrupulous businessmen used to order vetch from Australia, because of the item being too cheap and in bulk.

.....In Australia, vetch is used as an animal feed.

.....The vetch – imitation of 'Dal Masoor' – however, has larger grains as compared to lentil produced in Pakistan. 'Masoor' is delicious when cooked in comparison with vetch, which, however, has impressive looks.

.....The Government has alerted the consumers to beware of the imitation, which is being sold for lentil.

.....According to doctor Asghar Ali, "in Pakistan, we do not have the required expertise to analyse the contents of neurotoxins found in the pulses."

.....He proposed undertaking of a complete analysis of the pulses before its import so that its entry could be banned once neurotoxin contents are found and confirmed in the consignment.--APP

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Agriculture & Agri Exports/Imports

Government urged to confiscate vetch

ISLAMABAD (December 8) : The experts at the National Agricultural Research Centre (Narc) have recommended to the government to immediately confiscate vetch, fraudulently imported in Pakistan and being sold as *Dal Masoor*.

"Imported vetch, locally known as *Reewari* (a weed) contains dangerous neurotoxins and is unfit for human consumption," said Dr Habib-ur-Rahman and Dr Muhammad Bashir, Pulses Programme, Narc.

Talking to APP here, they termed a report, published in a section of the press, as incorrect which claimed that the vetch, if properly treated, is not harmful for human health.

To a question about the proper 'treatment' they said, "soaking vetch and discarding its washing can remove some of the toxin but not at all."

Consumers buy it as lentil *dal* and cook like lentil where soaking is not commonly practised, they said while adding, this inevitably results in higher consumption of neurotoxins.

The doctors expressed the apprehensions that the bill of lading of the consignment is probably changed during the course of shipment, "converting it into lentil *dal* from the vetch."

Pakistani importers are selling this toxic vetch in market as imported *dal Masoor* while cheating the customers, the experts said.

According to the experts, as it is difficult to conduct direct experiment on human being, studies on animals and poultry clearly showed its effects and week-old chicken died within a week when vetch was included in its diet.

The neurotoxin is chemically known as cyanoalanine and in split (*dal*) vetch its concentration is about 1 gram for every 100 gram vetch, they said, adding, therefore, the department of Health and Human Services of US Food and Drug Administration reported in 1992, that vetch (*Vicia sativa*) is not suitable for human consumption.

In 1993, the Grain Council of Australia reviewed export of Blanche Fluer vetch and concluded that it is unfit for human consumption, the doctors said.

The experts said, the Blanche Fluer variety of vetch grown in Australia closely resembles *Dal Masoor* (lentil) when split and has been exported to Pakistan in recent past in whole as well as in split form.

According to the experts at Narc, recently, a local importer made a contract with an important public institution.

But fortunately, the sample supplied was submitted to the Pulses Programme of

Complete ban on Australian 'toxic' lentil import demanded

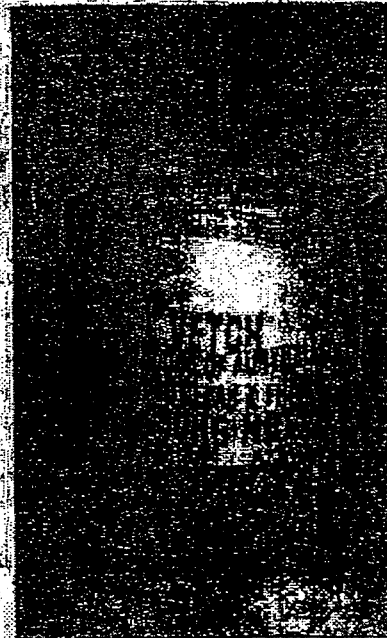
The Institute of Development Policy Analysis and Advocacy (IDPAA) of Proshika yesterday demanded a complete ban on import of vetch, an Australian species of lentil (like Mashur dal) which has detrimental impact on human body, reports BSS.

The IDPAA also demanded a withdrawal of this toxic item from the market immediately for the safety of public health.

Addressing a press conference in the GIRDAP auditorium here, Proshika President and ADAB Chairperson Dr. Qazi Faruque Ahmed said the dishonest and profit-monger businessmen of both Bangladesh and Australia should be taken to task and given exemplary punishment for trading with the public health.

Proshika Senior Vice-President Mahbubul Karim, IDPAA chief Shahabuddin, ADAB Director Shamsul Huda, Chief of Coalition of Environmental NGOs Shajahan Bhuiyan, Proshika Communication Advisor (Director) Joyti Prakash Dutta were present at the press conference.

Dr. Faruque pointed out that



A bag of Vetch found to be toxic. -Independent photo

this item had already been banned in many countries including India, Egypt and Saudi Arabia. According to a study conducted by Sri Lankan Scientist Dr. Sirimal Premakumar, 50,000 people of Cuba were seriously affected by continued con-

sumption of vetch, which is being sold in Bangladesh as 'Mashur dal'. The scientist also opined that the toxicity of vetch could impair the eyesight of a consumer.

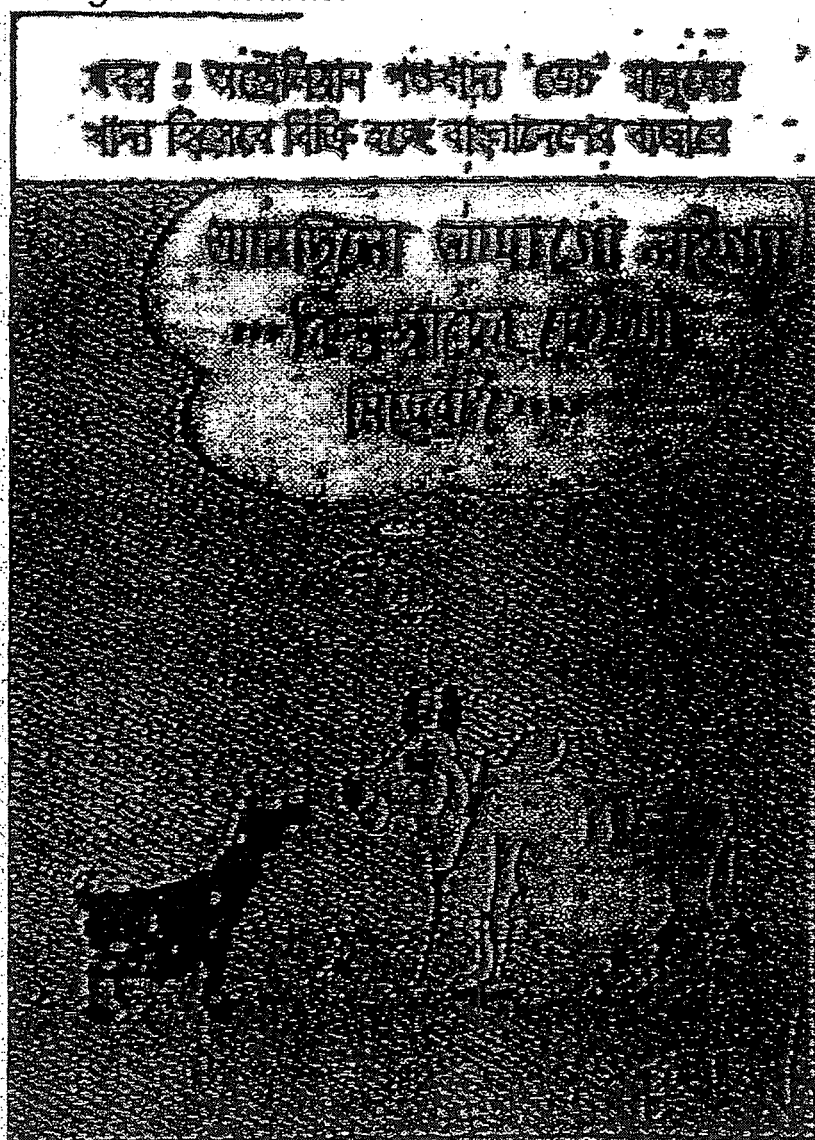
The IDPAA demanded an immediate announcement from the Australian government that vetch should no more be exported to Bangladesh or any other country. Since vetch does not even qualify as a safe animal food (stock feed), it should be banned for animals also.

Dr. Faruque Ahmed observed that a strong media campaign, including radio and TV, should be launched immediately to create awareness among the masses of this most dangerous food item. At the same time, he demanded that appropriate steps be taken by the authorities concerned to ensure that all food items imported from abroad are harmless and safe.

Giving statistics of scientific and research results on the item, Dr. Kazi Faruque Ahmed said it contains toxic called 'cynolanine' which can build up in the brains, livers and the nerve centres causing health hazards.

Today's Newspaper
(Dhaka, Bangladesh 16-10-99)

News Heading: Australian animal feed (vetch) is
being sold for human consumption in
Bangladesh markets



Cow ruminations to goat:
They bought it for us,-
but it is so tasty they decided to eat
it themselves.



H8*.

THE DEPARTMENT OF
THE PRIME MINISTER AND CABINET

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Dr Max Tate
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GLEN OSMOND SA 5064

Dear Dr Tate

Thank you for your letter to the Prime Minister of 18 October regarding the problem of Australian red lentil/red vetch substitution in Pakistan and Bangladesh. I am replying on the Prime Minister's behalf.

The Australian government is deeply concerned at the fact that some unscrupulous agents appear to be passing off Australian red vetch as red split lentils. It is both damaging for Australian trade and potentially harmful for unwitting consumers in the importing countries.

Earlier this year the government implemented measures to ensure all vetch and lentil shipments are inspected and properly labelled before leaving Australia. Unfortunately, it would seem that some vetch shipments are being re-labelled after leaving Australia, in areas outside Australian control. AQIS is examining how it might cooperate more closely with Bangladesh and others to identify these practices and those responsible.

As you know, the Australian government is working actively with industry and non-government experts on a more comprehensive approach to the problems associated with vetch exports. This includes developing strategies to communicate information to importing countries about the identification and preparation of vetch, and also examining a possible testing program.

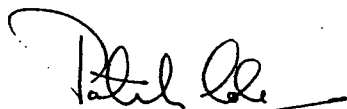
Relevant agencies are also examining the apparent practice of some Australian companies to label vetch as being fit for human consumption.

I understand that you have already been involved in discussions with government officials on possible remedies to the problem of vetch

substitution, and that you have indicated your willingness to continue to be involved. The government appreciates your efforts in this regard and looks forward to your continuing contribution.

Thank you for bringing this complex set of issues to the Prime Minister's attention. Your letter was especially timely given the then-impending visit to Australia by the Prime Minister of Bangladesh, Sheik Hasina, even though she did not in the event raise the matter with Mr Howard.

Yours sincerely



Patrick Cole
Assistant Secretary
United States, Rest of the World and Multilateral Branch
23 November 1999



H9*.

19th March 2000

ACH 070 440 067

Memo to Pulse Industry Members
Re: Vetch / Lentil Substitution Issue

You will be aware from our previous correspondence of the difficulties caused to the Pulse Industry following the re-emergence of this issue last year.

The compulsory inspection of shipments, and the labelling and certification process now put in place by the Australian Government provides absolute assurance to importing countries that no substitution can take place within Australia.

Although our activities to date have ensured that any lentils imported directly from Australia to countries of final destination are correctly described, and of the highest quality, we believe we must remain vigilant and active in working with our trading partners to ensure that substitution of vetch for lentils does not occur again within any of these markets. The potential harm that a future recurrence of this misrepresentation could have on the important and growing lentil industry and the Australian Pulse Industry in general is enormous. This is especially so should it be perceived or inferred that Australian Industry had in any way contributed towards continuance of such practice.

It is of the utmost importance that the whole Industry remains united to show importers and governments in our customer countries that the Australian Pulse Industry does not condone this practice and is determined to continue using all means at its disposal to prevent it happening.

There is at present no identified legitimate market for vetch in human food. It would be reasonably safe to assume that any export order received for vetch, requiring it to be split and polished, could be used eventually as an illegitimate substitute for lentils.

This letter is to urge all industry members in the strongest possible terms to avoid any such contracts, and to advise Pulse Australia should you become aware of any so that appropriate action can be taken.

Pulse Australia is continuing to work closely with AQIS and other Australian government departments along with the governments of importing countries to monitor this issue, provide assistance in testing and communication, and other measures to ensure that the credibility of Australia's Pulse Industry is maintained.

Yours sincerely

Gavin Gibson
Chief Executive Officer

The Whistleblower Experience: Return to Sender

